Skyways

1956

The Pioneer Publication of

- Pilot's Report: Cessna 182
- One Company's Fleet Costs
- Planes Add Business Flexibility
- How New 'Autopower' Works
- Round Table: Is Proximity-Warning Indication Needed?

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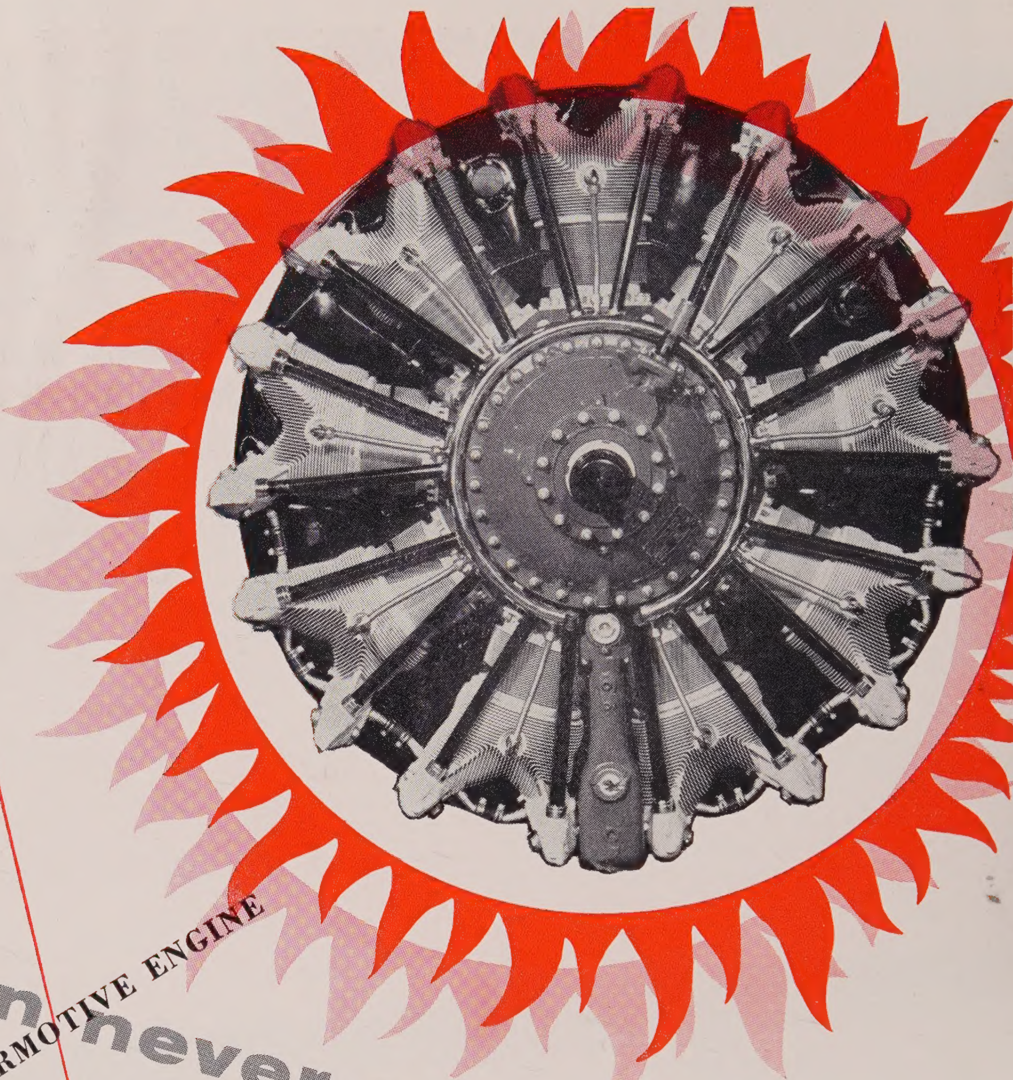

the sun never sets . . .

. . . ON A DALLAS AIRMOTIVE ENGINE

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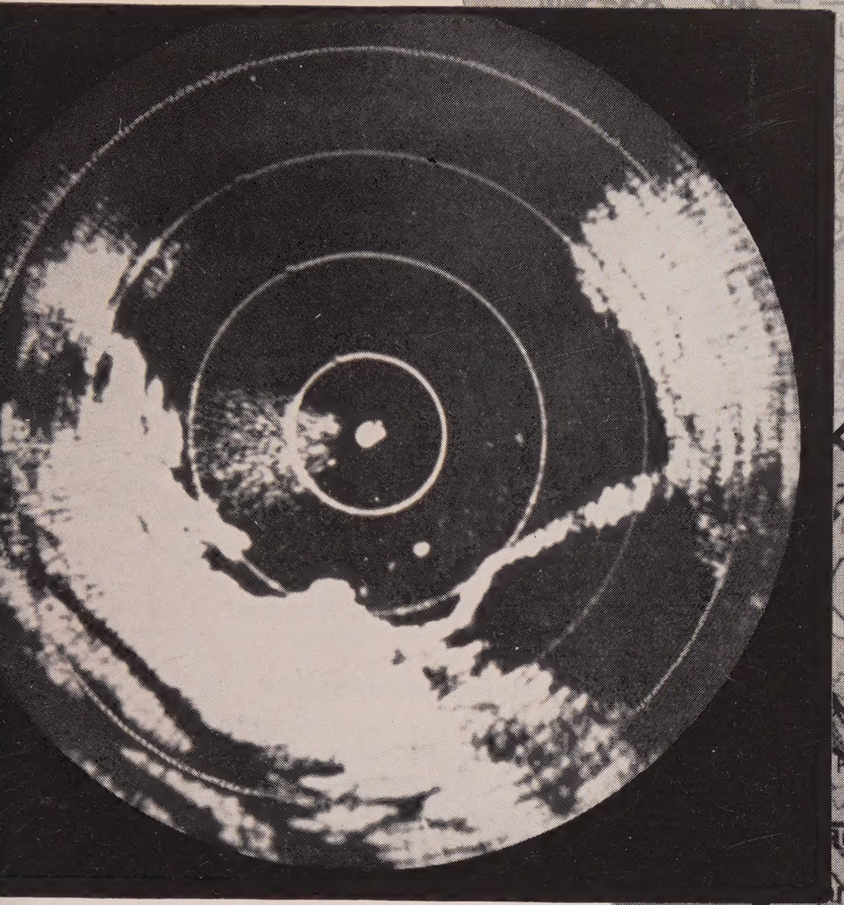
WHEN A PILOT NEEDS A LANDMARK...



Circled portion of aeronautical chart as seen on scope of AVQ-10
on in-bound airliner (Note Hayward-San Mateo County bridge).

Portion of sectional aeronautical chart looking north on San Francisco Bay area.

the exceptional ground-mapping properties of RCA's Weather Radar will spot his position

Air carriers find RCA's new Weather Radar (AVQ-10) invaluable in making landfalls and recognizing landmarks under adverse weather conditions in areas where navigation aids are comparatively inadequate.

The AVQ-10 provides a crosscheck on normal navigation methods, enabling the pilot and navigator to determine their position with great exactness relative to the coast line. This is equally true on inland routes where topographical features show up clearly on the scope. The AVQ-10 also helps to locate the proper entry point in defense areas, where aircraft are limited to "corridors."

These ground-mapping characteristics are in addition to the recognized superiority of the AVQ-10 as a weather radar. It is the first airborne radar to use the C-band (5.6 cm) transmission, the wavelength best suited to weather detection and avoidance, yet having the least amount of scope clutter. With it, the pilot can evaluate storms up to 150 miles ahead and pick non-turbulent paths between them. In addition to avoiding costly detours, the AVQ-10 contributes materially to passenger comfort.

All this has made the demand for the AVQ-10 great and pressing. Many leading airlines have already specified it. To secure early installation, other airline and executive plane operators are invited to write now for further information.

CUSTOM AVIATION EQUIPMENT
RADIO CORPORATION of AMERICA
11819 W. Olympic Blvd., Los Angeles, Cal.

MAY, 1956

Skyways

The Pioneer Publication of Business Flying

COVER: Cessna's latest, the new tricycle-geared 182

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now hear this . . .

PERSONNEL

James P. Malmstrom has been appointed general manager of United Aircraft Products, Inc. **L. Gearhart,** until recently director of technical publications for United, has rejoined the Speer Advertising Agency as vice president in charge of industrial accounts.

George W. Haldeman, special assistant to the director of aviation safety of CAA, has joined National Airlines.

John E. Lee has been named manager of the pricing and scheduling department at Lockheed Aircraft Service-International at Idlewild Airport. He succeeds **Donald I. Smith** who resigned recently to become president of Airseco, Inc.

Louis Reiss, treasurer of Pratt & Whitney Co., Inc., has also been named controller.

F. R. Fletcher recently was named field representative of the Seattle branch of General Controls.

Galen Potter has been appointed sales manager of the executive and corporate aircraft seating division of Hardman Tool and Engineering Co.

Robert L. Robertson recently was named superintendent of the aircraft division at Dallas Aero Service.

Maj. Gen. Victor E. Bertrandias, former Deputy Inspector General of the USAF, has been retained by Pan American World Airways as an advisor on jet operations.

David H. Rotroff has been named by Braniff International Airways as district sales manager for the airline's new Chattanooga, Tenn., sales and reservation office.

Walter P. Plett, a veteran of 22 years of service with the CAA, has been appointed regional administrator of the CAA at Los Angeles.

John B. Borah has been named district sales manager for the Kansas, Missouri, Texas area for the Weatherhead Co.

Stanley D. Zemansky recently was appointed assistant to the general manager of the autonetics division of North American Aviation, Inc.

Eric G. Boehm recently was named general manager of the hydraulics division of Houdaille Industries, Inc.

D. R. Gero, vice president of G. M. Giannini & Co., Inc., has been appointed Western operations manager.

David A. Highman has been appointed staff manager commercial and military airfreight sales for American Airlines.

Arvid E. Olson, Jr., has been named assistant to Northrop Aircraft, Inc.'s director of military relations and customer service.

William P. Ferree, district publicity representative for United Airlines in Los Angeles for more than two years, has been named West Coast public relations manager for KLM.

Walter T. Clark, Jr., recently was named sales engineer for Dallas Aero Service.

Charles L. Sharp, veteran test pilot and aeronautical engineer, has been ap-

(*Continued on page* 46)

Washington report . . .

NBAA Asks 'Non-Safety' Channel

The National Business Aircraft Association is making a major effort in Washington to obtain air-ground communication service for business and private aircraft, since the CAA had to discontinue its towers and communications stations from handling "non-safety" messages several months ago. Sometimes business and private aircraft operators have been delayed up to 60 minutes waiting for surface transportation or servicing facilities, because of inability to contact airport operators in advance to advise of their needs.

NBAA recently asked the Radio Technical Commission for Aeronautics Special Committee 56 to study ways and means of providing a general purpose, non-public, air-ground communication service. To expedite this request, an informal meeting was called last week by its chairman, C. A. Petry, technical services director for Aeronautical Radio, to explore the feasibility of obtaining a public telephone communication for air-ground communication for business, private and airline aircraft.

Attending the meeting were aircraft users, suppliers and manufacturers of equipment, who discussed the possibility of early development of suitable facilities. Petry indicated that such facilities could "probably" be established in the UHF frequency.

National Association of State Aviation Officials has proposed that A T & T and affiliated companies be invited to install and operate air-ground phone service at ground facilities throughout the nation. NASAO's board of directors also strongly urged that Federal Communications Commission allocate a suitable frequency in the aeronautical band in support of NBAA's request to RTCA.

Frequency allocation may prove a serious problem. Recent applications to FCC requesting allocation of 123.0 mc have been rejected because of international agreements, although it is presently unassigned.

Controllers Form Organization

Organization of a professional society for some 5000 to 6000 CAA, Air Force and Navy air traffic controllers recently moved into final stages in Washington. Sponsoring the activity are Clifford P. Burton, former CAA chief of airways operations, as executive director and former CAB chairman Oswald Ryan as its general counsel.

The constitution and by-laws are being drafted for the proposed group, which is to be called the "Air Traffic Control Association." Copies are now being printed and will be mailed to some 600 CAA towers, communications stations and potential corporate organizations such as airlines and aviation trade associations within the week.

The primary aim of the proposed ATCA, Burton told the NBAA, is to develop professional stature for traffic controllers and to provide a medium for the useful exchange of experience and know-how.

industry notes . . .

■ Chicago's first industrial heliport was given final inspection and approval recently. It is atop the home office of Radio Materials Corp., and was built to speed executive travel between Chicago and the company's Attica, Ind., plant. Time saved per executive in moving between the plants by helicopter is expected to equal one day a week.

■ Continental Aviation and Engineering Corp., Detroit, Mich., has received an Air Force contract for $9,312,766 to cover production of J69-T9 gas turbine jet engines. The engines will power Cessna T-37 twin-jet Air Force trainers. The T-37, developed by Cessna with Air Force aid, has been described as a possible "four-passenger executive jet of the future."

■ Collins Radio Co., Cedar Rapids, Ia., has sold 16 VHF Omni Range ground stations to the British Ministry of Transport and Civil Aviation, London, Eng. Eight of the stations will see use in the United Kingdom, while the others will be installed in various British colonies.

■ Hamilton Standard, division of United Aircraft Corp., Windsor Locks, Conn., will soon set up a new operations branch for specialized aircraft equipment engineering and development at St. Petersburg, Fla. Hamilton products will still be made at the main plant at Windsor Locks.

■ Cessna Aircraft Co., Wichita, Kans.—which recently put its common stock on the New York Stock Exchange's "big board"—says that its Model 620 four-engined, seven to 10-passenger executive transport project is in the prototype final-assembly stage and will be test flown "in the near future." Production planning continues during testing. Enthusiasm for the 620 and its corporate-executive potential has reportedly been expressed by some 200 corporation pilots and executives who have seen it.

■ One to 10-place utility and executive plane deliveries continued to increase in January and February. Seven companies, who publish shipment information report 509 January deliveries and 576 in February. Of the two-month total, 953 were four-place or more models, and 130 were two-place. The two 1956 months exceeded individually the December, 1955, total of 459 shipments.

■ Air and ground testing of airborne electronic equipment can now be done in a special flight laboratory for the purpose just created by the Radio Corporation of America at the New Castle Airport, New Castle, Del. To be used for pre-flight and in-flight testing of RCA equipment, the laboratory is expected to be completely equipped with maintenance and test apparatus sometime in the month of May.

■ The Frye Corp., Ft. Worth, Tex., has received "definite commitments" for six Frye four-engined *Safari* transports and "options for more" from two Alaskan airlines, Consolidated Airlines, Inc., Anchorage, and Wein Alaska, Fairbanks.

■ Allied Instrument Manufacturing Corp., Houston, Tex., has been appointed exclusive distributor in the United States for the Model 2-DG Gyro Direction Indicator by Smith's Aircraft Instruments, Ltd. The gyro boasts several "new and exclusive features."

■ Twelve 440 *Metropolitan* transports have been purchased by Eastern Air Lines from the Convair Division of General Dynamics Corp. Several U.S. companies have already bought *Metropolitans* for corporate and executive-transportation use. These, and orders from foreign airlines, bring the total sold to 86.

■ Southwest Airmotive Co., Dallas, Tex., has made the first bid by a non-manufacturing facility for jet engine overhaul business whenever such service is needed. The overhauls would be done in the giant SAC hangar at Love Field, now busy with similar work on Air Force jets.

■ The Aircraft Industries Association's Aircraft Year Book for 1955 came off the presses last month. Details on page 51.

One Company's Business Fleet Costs

Exactly what does the dollar-and-cents ledger sheet of a business aircraft operation look like? Many businessmen, although long-ago convinced of the rock-solid practicability of business aircraft, simply couldn't answer that. Many a business pilot, wise in the ways of company-plane utilization, might have the same trouble. For the simple fact is that the lore of the business fleet has often obscured the ledger. SKYWAYS, in this special report, presents the first such complete ledger made public of an actual business aircraft operation. Company names and some business details, out of deference to the wishes of those who so closely co-operated in this study, have been disguised. But the facts are unchanged. The intimate cost accounting and operational problems revealed are exactly as they happened in actual experience.

Let's just call it The Company. Its operations are in a key field of the American economy. It isn't the largest in its field, but it isn't the smallest by any means. It is well established and very well respected. It operates over a broad area. Production is concentrated in the western part of the country. Administration is in the east. Sales carry the company into the other areas of the country.

The Company needs wings. And it has them.

During the two-year period which this SKYWAYS study covers, The Company operated 22 aircraft based at various locations.

Eleven multi-engine pilots, 12 single engine pilots, and 12 co-pilots flew those planes a total of 3,630,357 airplane miles. Not a single injury arose from those millions of miles.

The Company figures its gross investment in the 22 aircraft to be $1,259,826. But, of that, $877,544 is earmarked as reserve for depreciation. This leaves a net investment from The Company of $382,282.

The Company's aircraft roster includes the following types: Two- and four-seat single engine planes, medium twin-engine planes and heavier twins such as the *Lodestar*, DC-3 and PV-1. The roster of makes includes also: Twin Beeches, *Bonanzas*, Cessna 140's, and the DeHavilland *Dove*.

Considering the line-up of planes, an immediate question will occur. How was the investment in these planes kept to its comparatively low total?

The first part of the answer is "surplus." With the exception of the *Bonanzas*, the *Dove*, and one Twin Beech, all of the planes were purchased from surplus.

Secondly, except for the DC-3, all of the planes were overhauled, modernized and refitted in The Company's own shops.

How large is the shop staff? Seven senior mechanics top the list. Three junior mechanics help them. A painter and a janitor round out the roster. All flight personnel hired, however, are required to have A&E ratings and thus can take their places on the shop roster during "annuals," engine changes and modifications.

The fleet described is not the "ultra" fleet of some major companies. A company, for instance, that buys a single Convair 340 may nudge close to having as much money tied up in a single plane as The Company has in its 22. (What The Company's own people want in the way of new equipment will be discussed later.)

To get right down to the golden tacks of business aircraft operation, how much has it cost The Company to operate its fleet?

First, some rough figures that cover the entire Company life of the planes.

The plane that has cost the most per mile flown, all factors considered, is the Lockheed PV-1. In three years with The Company it has flown 273,029 miles at a cost of $1.515 per plane mile.

One of the factors significantly affecting the PV-1's per-mile cost, however, is the depreciation figure assigned the craft. It depreciates, The Company figures, at 44.5 cents per mile, or 29.40 per cent of the total cost. That depreciation cost is the highest of any plane owned by The Company. The next highest, that of the DC-3, is 29.14 per cent of the plane's total cost per mile which is attributable to the depreciation.

The lowest depreciation is that of the highly salable Cessnas that depreciate at a rate equal to 6.49 per cent of total cost.

The Cessnas, too, have the highest average rate of annual usage, some 851 hours.

An accompanying tabulation breaks down the costs for all of The Company's planes.

Of interest, however, is a further comparison of totals of flight and ground expenses and depreciation.

The PV-1's total flight expenses, for instance, are, in The Company's calculations, 81.8 cents per mile. This represents 53.97 per cent of total per-mile expenses. The ground expenses for the plane are figured at 25.2 cents per mile, or 16.63 per cent of the total.

Those PV-1 sub-totals compare this way to those of the DC-3 which was next in line as to amount of depreciation per mile:

The DC-3's total flight costs are 85.9 cents per mile which is 56.78 per cent of the total while the total ground costs are 21.2 cents per mile which is 14.08 per cent of the total.

Those sets of figures clearly show the danger in trying to account for individual plane costs in a lump fashion. The PV-1 while higher in point of rated depreciation is less expensive in flight—but more expensive on the ground than the DC-3. It is clear throughout the tabulation that these balances of cost must be considered for all planes.

The items figured into the accumulative per-mile cost charts of The Company are these:

For flight expenses, operating labor, traveling expenses, fuel and lubrication, insurance, and the miscellaneous details of flight operations are included.

It will probably come as no surprise to note that except for depreciation (in the case of the big planes) the highest single factor involved in the flight expenses is "operating labor."

That factor runs from a low, percentagewise, of 22.25 per cent for the PV-1, to a high of 46.29 per cent for the Cessnas. Dollarwise, of course, the Cessna cost is only 6.5 cents per

mile but, nevertheless the high percentage factor serves to point out the highly skilled nature of the "labor" involved in business flying, "labor" for which good salaries are both called for and deserved.

The factors figured into the ground expense tabulations are taxes and licenses, hangar and port expenses, maintenance and repairs.

Because hangar and port charges, as well as taxes may vary widely according to individual operations, it is the repair and maintenance figures that may be most universally significant here.

Percentagewise, the "r & m" factor for The Company is highest in the case of the *Lodestars* where this category takes up 18.83 per cent of total costs. Dollarwise, too, the *Lodestar* charges are highest in The Company's figures, showing 19.8 cents per mile.

In this connection, of course, the *Lodestars* have twice the length of service with the Company as have the PV-1 and DC-3—and repairs and maintenance necessarily increase with age.

The lowest figures are for the DC-3 which shows 7.74 per cent of its total costs as repair and maintenance. That represents 11.7 cents per mile—a dollar cost which is above, of course, such light plane repair maintenance figures as that for the *Bonanzas* which, although 8.06 per cent of operating expenses, comes to only 2 cents per mile. Full charges are shown for all planes in an accompanying chart.

Adding together and separating flight as opposed to ground expenses for all the remaining planes shows this line up:

The *Dove* takes up 59.48 per cent or 44.1 cents per mile of its costs in flight expenses with 9 cents or 12.27 per cent on the ground.

The Twin Beeches use 65.40 per cent in flight (35.6 cents per mile) and 15.33 per cent and 8.3 cents per mile on the ground.

The *Lodestar* figures show 55.04 per cent of costs in flight (58.1 cents per mile) and 23.53 per cent or 24.8 cents per mile on the ground.

The *Bonanzas* figure in with 71.30 per cent of costs as flight expenses (17.7 cents per mile) and 12.24 per cent or 3.1 cents per mile in ground expenses.

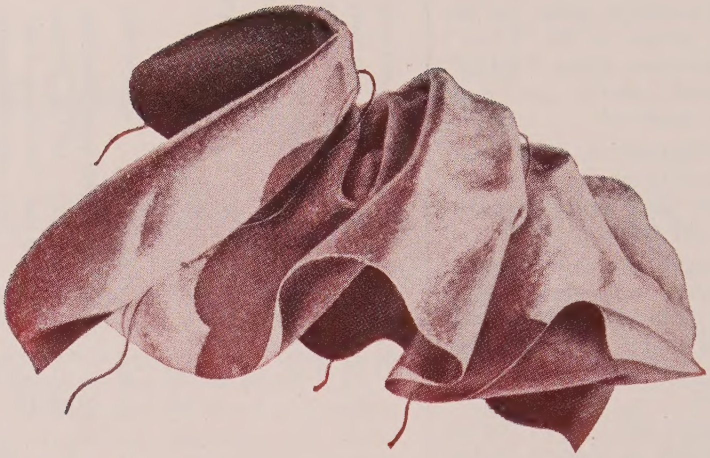
The Cessnas show 78.71 per cent of their costs as flight expense. This means 10.9 cents per mile. The ships' ground expenses are 14.80 per cent of the total or 2.04 cents per mile.

The lighter the plane, naturally enough, the higher the percentage of flight to ground costs.

(Continued on page 42)

ANALYSIS OF ACCUMULATIVE COSTS OF AIRCRAFT OPERATION BASED ON HOURS OF UTILIZATION WITH ALL FIGURES ACCUMULATIVE FROM DATE OF ACQUISITION TO 12-31-54

Item	DC-3		PV-1		LODESTARS		DOVE		BEECH TWINS		BONANZAS		CESSNAS	
	Accumulative Cost Cents Per Mile	Per Cent of Total	Accumulative Cost Cents Per Mile	Per Cent of Total	Accumulative Cost Cents Per Mile	Per Cent of Total	Accumulative Cost Cents Per Mile	Per Cent of Total	Accumulative Cost Cents Per Mile	Per Cent of Total	Accumulative Cost Cents Per Mile	Per Cent of Total	Accumulative Cost Cents Per Mile	Per Cent of Total
Total Hours Flown	1,509		1,245		6,599		1,434		15,588		13,560		12,481	
Average Annual Hours of Utilization	395		404		368		593		620		428		851	
1. Flight expenses:														
Operating labor	0.381	25.19	0.337	22.25	0.244	23.16	0.214	28.89	0.170	31.23	0.095	38.73	0.065	46.29
Traveling expenses	0.046	3.03	0.044	2.90	0.053	5.07	0.041	5.48	0.031	5.70	0.019	7.52	0.012	8.65
Fuel & lubrication	0.235	15.55	0.267	17.65	0.185	17.49	0.095	12.77	0.094	17.28	0.024	9.45	0.018	13.04
Insurance	0.134	8.88	0.109	7.18	0.081	7.66	0.056	7.62	0.040	7.30	0.027	10.95	0.009	6.81
Miscellaneous	0.063	4.13	0.061	3.99	0.018	1.66	0.035	4.72	0.021	3.89	0.012	4.65	0.005	3.92
2. Ground expenses:														
Taxes & licenses	0.006	0.43	0.007	0.44	0.002	0.19	0.003	0.39	0.003	0.64	0.002	0.65	0.0004	0.25
Hangar & port	0.089	5.91	0.083	5.51	0.048	4.51	0.021	2.90	0.018	3.30	0.009	3.53	0.005	3.63
Maintenance & repairs	0.117	7.74	0.162	10.68	0.198	18.83	0.066	8.98	0.062	11.39	0.020	8.06	0.015	10.92
3. Depreciation	0.441	29.14	0.445	29.40	0.226	21.43	0.209	28.25	0.105	19.27	0.041	16.46	0.009	6.49
Totals	1.512	100.00	1.515	100.00	1.055	100.00	0.740	100.00	0.544	100.00	0.249	100.00	0.1384	100.00
Total Expenses	$401,737		$413,585		$1,271,332		$167,855		$1,445,025		$482,639		$158,644	
Statistical Data:														
Total miles flown	265,612		273,029		1,204,899		226,962		2,656,956		1,940,059		1,144,610	
Cost per plane mile	$1.512		$1.515		$1.055		$0.740		$0.544		$0.249		$0.138	
Total hours flown	1,509		1,245		6,599		1,434		15,588		13,560		12,481	
Cost per hour flown	$266.22		$332.19		$192.65		$117.05		$92.70		$35.59		$12.71	



THE WRAPS ARE OFF

The New 680 Aero Commander

WITH LEAR ABUNDANTLY DESIGNED INTO IT

When the high-performance Model 680 "Super" Aero Commander was at the design stage, specific structural and space provisions were made for Lear equipment—complete Lear L-2 autopilot system with automatic altitude control and automatic approach coupler—Lear LVTR-36 VHF crystal-controlled 36-channel transceiver—Lear Model 2200 marker beacon receiver—Lear ADF-14C automatic direction finder—Lear LTRA-6 VHF transceiver system with omni—Lear broadband VHF antenna. All these units have been installed in company demonstrators, and Aero Design and Engineering Co. officially offers this complement of Lear equipment.

Take a tip from the builders of the great new 680 "Super"... specify Lear!

LC-30

LEAR LEARCAL DIVISION, 3171 S. BUNDY DR., SANTA MONICA, CALIFORNIA

Business Aircraft Add Flexibility To Company Operations

By Jean H. DuBuque

Executive Director—NBAA

February 15, 1951 has proved to be a red letter date on the official records of the Thatcher Glass Manufacturing Co., of Elmira, New York. On that day, the company added greater flexibility to commercial marketing of its glassware products by purchasing a twin-engine Beechcraft for company officials travel. Since that time, the requirements for air transportation increased so rapidly that Thatcher was forced to sell the small plane and acquire a Lockheed *Ventura* to meet the demand for more passenger seats and longer range.

Equipped with the latest instrumentation, communication equipment and safety devices, the Thatcher *Ventura* is a valuable business transportation media for airminded company officials. Presently it has a dual Collins Omni, Zero Reader, Bendix VHF Transceiver, and an ARC-1 Transceiver for standby purposes. Recently a Bendix RDR-1 radar was installed and a NARCO DME (distance measuring equipment), Sperry integrated instrument system, Aerojet General's JATO, and new R-2800 Mark One engines are soon to be added.

The company plane and personnel are under the direct supervision of the chairman of the board, Franklin B. Pollock. Flight personnel are J. Sheldon "Torch" Lewis, chief pilot; and Richard G. Muller, co-captain. Both pilots have airline transport ratings and both are equally familiar with the operation of the aircraft and emergency equipment from either seat as they alternate right and left seats. Joseph Vernali, an A&E and DAMI, is in charge of maintenance. Vernali is very thorough in his job which gives pilots and passengers an added sense of confidence. Fewer than five company flights have been cancelled in five years because of a maintenance problem.

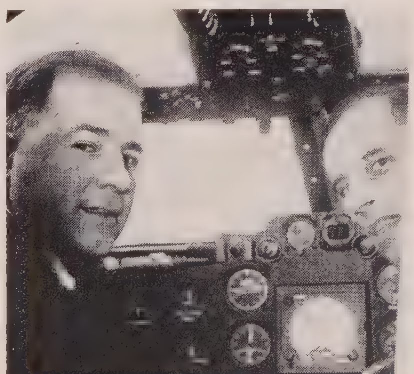
Substantially, Thatcher's flying is between points east of the Mississippi. This is not to say that flights are not made outside of this area. Forty-four states have seen the Thatcher trademark on the side of the Lockheed fuselage as well as Canada, Nova Scotia, Nassau, Cuba, and Mexico.

Like most corporation planes, New York City is a frequent port of call for the busy Thatcher crew. Teterboro is used as their New York terminal and Chief Pilot Lewis has this to say about Teterboro's facilities.

"Using Teterboro saves us an average of from 15 to 20 minutes per flight because we do not have to compete with any airline traffic under VFR conditions. Under IFR conditions, we are only tangled with airline traffic (other than en route) over Newark Outer Marker. Our average holding pattern is ten minutes. December 15th, for instance, we held about 20 minutes (over West Point) with no delay at Newark. The EAC time at LaGuardia was running from 45 minutes to 1 hour, five minutes at that time. We landed without delay."

According to Lewis, flying for a progressive corporation like Thatcher Glass Mfg. Co. allows for few dull moments. Each day presents a different operation, different destinations, different weather, different people and different problems.

"I think that we have run the gamut of bizarre cargo," says Lewis. "Cats, kids, canines, canaries, even a mynah bird have been logged aboard. However, no special trips have been made for any livestock. We just happened to be going in the same direction as the packaged parakeet or the caged canary and took them along with us for the ride."



CHIEF PILOT *Sheldon Lewis and co-pilot Richard Muller smilingly display new Bendix RD-1 radar scope on PV-1's panel.*

Thatcher's youngest passenger was a young lady of three weeks; the oldest a spry gentleman of 85. Movie stars, politicians, a governor, a man dying of cancer, leaders of industry, and countless stranded GI's have all signed the guest book in the Thatcher plane.

"Mr. Pollock is a real softie when it comes to giving a stranded GI a lift," Lewis remarked. "Once when we were in Charleston, S.C. he filled the three remaining seats with New York bound, freshly starched young Marines, 12 hours out of boot camp at "P.I." Their collective prospects of getting north that day had just been dashed by the overstuffed airline. The looks on their grateful faces on debarking in New York were sufficient thanks for anyone."

There have been interesting trips and breathtaking spectacles. On a trip from Denver to Phoenix in 1953, the Thatcher *Ventura* picked up the Colorado River at Grand Junction. It was a smooth and cloudless day so for the next 350 miles the plane flew at low altitude along the rim of the Colorado through the badlands of Utah, the ancient Navajo country, around the Painted Desert, arriving over the rim of the Grand Canyon in late afternoon as the great canyon was at its height of grandeur. According to Lewis, the passengers indicated that there simply has never been a view to compare with the one they saw.

Other notable views during company flights have included Popocatapetyl Mountain (Mexico), Acapulco, the Florida Keys, the approach to White Sulphur, Havana and the Malecon, Los Angeles on a clear night, the Everglades from 500 feet, Pike's Peak, Death Valley in the early morning and Manhattan at anytime.

Thatcher officials well know that it pays to have the plane in constant

(Continued on page 44)

High Performance For Amateur Fliers

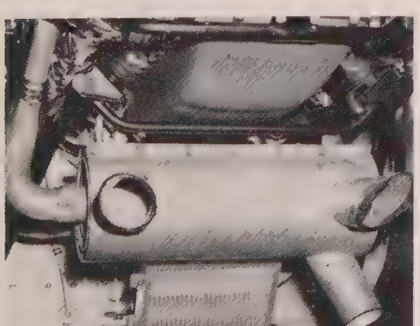
By Norman Jacobshagen

A new breed of airplane is coming off the production line of the Cessna factory at Wichita. They took the use-proved 180 and bred it to the tricycle gear recently introduced on the 172. The result is called the 182 . . . and it's an airplane that the factory seems to be mighty proud of and pleased with. After flying it for an hour and a half, I'm ready to agree.

With the exception of the tricycle gear, there is no noticeable change in appearance from the 180. The cowl has been redesigned and there is no longer a cowl flap. In addition to making for easier fabrication, it makes for safer and easier flying with one less operation for the pilot. Elimination of the cowl flap was made possible by mounting the oil cooler radiator in a vertical position and doing some redesigning on the engine baffling. Other than the cowl, everything else about the 182 is identical with the 180.

The nose wheel is steerable through 10 degrees and then swivels through 30 degrees. This is a feature that gives easy ground handling when working out of tight parking quarters. The prop has been shortened six inches from the 88 inches swung on a 180. The tips have been squared off and I'm told the loss in efficiency has been negligible. Shortening the prop has given a normal ground clearance of 11 inches. And should the very worst happen, there are still seven inches of clearance with both tires flat and the nose wheel strut completely compressed. With this safety factor, there doesn't seem to be much chance of ever putting the prop into the ground.

CESSNA *182 is result of applying tricycle gear to the 180 and redesigning the 180's cowl, eliminating the cowl flap. An 82-inch prop gives 11-inch ground clearance.*



MUFFLER *system is a completely new design. It helps add to what Cessna calls "Hush-Flight." One large muffler and a single stack cut noise to a minimum.*

At the front end of the airplane I ran into a small item that even John Ward, a regional sales manager assigned to show me the airplane, didn't know about. Just back of the nose strut is a tie-down ring. No longer will it be necessary to throw chains or ropes around the nose wheel. While this is a small item, it's one of the nice little touches that makes for additional convenience that is always appreciated by owners.

The main gear is exactly like the 172 except for the fact that it has a wider tread and is placed 11 inches farther back on the fuselage. This, in turn, throws the step farther back and you have to take a longer step to get into the front seat. But even with this, entry is made without going through any of the old acrobatic contortions.

The interior was bright and cheery with blue nylon fabric and white tailored vinyl seat bolsters and scuff panels. It should be easy to keep clean and new looking through many hours of hard use. And here I found another of the extra touches. Small straps have been sewed to the sides of the seat cushions. The seat belt slips through the loop. This keeps the belt right at hand. No longer will you have to fish and hunt all over the floor and then get the belt mixed up with the one for the seat next to yours.

The instrument panel is neat and uncluttered. Instruments seem well placed and easy to read. There is plenty of room on the lower part of the panel for multiple radio installations to suit any owner no matter how particular he may be.

A couple of shots of prime, a touch on the push-button type starter and the engine rumbles into life. If you haven't had an opportunity to fly the 172 you're in for a real kick. Visibility is near perfect and taxiing is easy as driving a car. The biggest trouble is to keep from going too fast. You're hitting 40 mph before you know it. But even if you hit a turning point too fast there's no need to worry. The tires may squeal, but the airplane will feel just as solid as a sport car and there's no worry about scraping a wing tip.

It seemed to me that the nose wheel steered more stiffly than the 172. This could be explained by the gear being 11 inches farther back and a heavier motor sitting over the nose wheel. Not only did it seem stiffer but the response seemed slower. Experimenting a little, I found that a slight back pressure on the elevators took weight off the nose and made steering effort easier and response quicker. Normally this would never be necessary, but the remarkable effectiveness of the elevators at slow speed will give it to you if you desire.

A quick check on the mags and the controllable pitch prop, a last visual look at the trim tab and gas valve located between the seats, and we were ready for takeoff. We had half tanks of gas, three passengers and the

(*Continued on page 47*)

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Chief, Aviation Development Division
The Port of New York Authority

"What you're really flying is that wing out there."

In one form or another I have used that statement in countless discussions. It means simply that all basic flight-characteristics and pilot information for flying a given aircraft is really contained on the external surfaces of any wing. The pilot can't see it either inside or outside the cockpit. This vital and positive aerodynamic information, the very reasons you get into the air and maintain all aspects of flight, up to now has not been available to the pilot in the cockpit. It has been like being in the dressing room of the gorgeous Radio City Rockettes with the lights out. You know all the precious characteristics are around you, but unfortunately you can't appreciate any of them because you can't see them. In other words on that long, slender airfoil gather all the forces that make flying possible.

For many years, some in aviation have pondered the problem of conveying to the pilot information about the aerodynamic forces acting on the wing. A tremendous job has been done on engine information and information from many other sources, but wing information has trailed behind. During my many years as a test pilot, on occasions we stuck short pieces of string all over the wing surfaces and other areas of our ships to observe the aerodynamic character. After flying a particular aircraft for a while and watching the tufts during all flight attitudes, I could almost fly it through any basic maneuvers simply by watching the strings as they danced in the airstream. This was a primitive wing information indicator, but it worked, and above all it was conveying positive information that could not be disputed.

Almost three years ago (SKYWAYS July 1953), I had a chance to fly one of Safe Flight Instrument Corporation's ships equipped with their *Speed Control* electrical lift detector. The corporation had started out after World War II with a stall warning device. This brought basic lift information into the cockpit. *Speed Control* was a step further. It used the stall warning device as a building block and went on to tell the pilot through an indicating instrument when his airplane was at correct speed during take-off and landing.

Now Safe Flight has gone one step further in providing wing lift information for the pilot's use. They recently announced *Autopower*, an addition to and extension of *Speed Control. Autopower* automatically controls the aircraft engine throttles during landing approach maneuvers. It makes an airplane climb, glide, or maintain level flight with automatic adjustment of the required engine power in the low speed range. The source of information for *Autopower* is again the wing.

A few weeks ago I had a chance to fly Safe Flight's *Autopower-equipped* DC-3. But before telling you about this flight and giving you my first-hand appraisal of *Autopower*, I'd like to describe the various components, the building blocks, that have led up to this latest aviation development.

The first element is the wing lift transducer which is mounted on the lower leading edge of the wing. Built to operate in all environmental conditions, the small projecting wing lift detector tab reads the pressure pattern on the lower leading edge which is related to the angle of attack and the lift coefficient. The measurement is independent of the aircraft's gross weight, turning accelerations and "G" effects; it also takes into account wing aero-elasticity, and compensates for temperature and pressure altitude.

Information from the wing lift transducer and from a flap potentiometer, which is linked to the flap operating mechanism and provides additional compensation for the aerodynamic effects of various flap positions, is fed to a lift computer. There are no electronic tubes in the computer; rather, simple electrical bridge circuitry is used to provide a signal for the panel indicator.

In the computer, a longitudinal accelerometer resolves the thrust and drag components to give speed control compensation for all engine power

(*Continued on page* 48)

Is Airborne Proximity Indication for Collision Warning Needed?

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

May 1956

Statler Hotel
Washington, D.C.

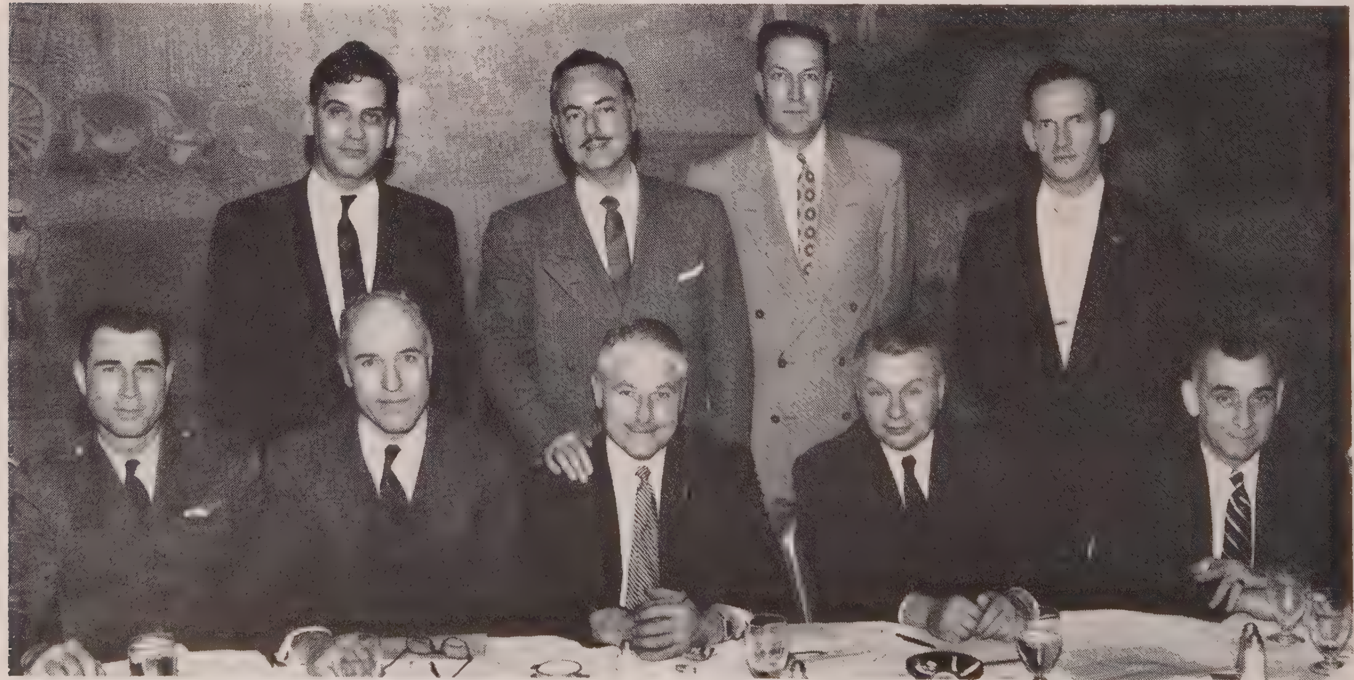
Airborne Collision Danger Recognized as Major Problem Facing Industry; Solution Lies In:

- **Prompt Development of Simple Warning Device**
- **Further Research on Collision Problem**
- **Continued Joint Efforts by Industry**
- **Search for Aids Other Than 'Black Boxes'**
- **Device Giving Pilot All Collision Factors**
- **Automatic Solution of Proper Evasive Action**
- **Reading Danger at Greatest Possible Range**

Capt. Carl Christenson *(United Air Lines):* "Thanks to SKYWAYS Magazine we are assembled here today to discuss the question *Is Airborne Proximity Indication for Collision Warning Needed?*

"In order to set the stage for such a discussion, it is important that we all understand the growth potentials of the aviation industry and the basic problems involved in the air collision problem. In the early stages of this industry, we were confined, more or less, to low altitude flying and speed ranges that offered simple solutions to the collision hazard. The see-and-be-seen principle as such was, in most cases, adequate. As the industry began to grow, it was necessary to institute traffic control procedures to handle the growing traffic problems. At the same time, very rapid developments began to take place in private flying and, of more importance, in the military installation.

"Now we are confronted with the entirely new problem of high altitude travel at much greater speeds than ever were anticipated during the early periods of flying. The number of aircraft involved is steadily increasing. As we



PROXIMITY *warning indicator discussion was attended by (L to R, seated) Lt. Col. O. O. Sisler, USAF; Merrill Armour, AOPA; Capt. Carl M. Christenson, United Air Lines; Jerry Lederer, Flight Safety Foundation; W. B. Barnes, CAA; (L to R, standing) A. D. Hughes, Washington correspondent; Jean DuBuque, NBAA; C. F. Timmerman, ATA, G. W. Church, Bendix Radio.*

discuss this problem, I think it important that we keep in mind that the growth of this industry has just started, that speeds will continue to increase, that the airspace will increase altitude-wise, and that new problems will come along. We also are going to have more severe use placed upon the lower altitudes because of the continuing growth of private flying.

"With respect to the high altitude problems, we have the job of accommodating the military operation and its specific missions along with the trend of airline travel in these high altitudes. In the lower atmosphere we are dealing with speeds in the order of 300 to 400 miles an hour. As we go higher, there's no question but what we will go up to Mach one. By 1970 or '75 even the air transport industry is going to be talking about Mach one to one point five, perhaps two. All this means that we're going to have to find ways and means of flying throughout the continental limits of this country and over the surface of the world with a freedom from collision danger.

"Now, in order to bring in some information relative to the severity of the problem, I'd like to ask Mr. Jerry Lederer, our good friend from Flight Safety Foundation, to tell us about current collision danger experience within the entire aviation industry."

Jerry Lederer *(Flight Safety Foundation)*: "It is very appropriate for SKYWAYS to have this Round Table since SKYWAYS devotes its attention to the problems of the non-air carrier, especially the business pilot. Few people realize that there's a great deal more flying going on outside the airline field than within. Last year general aviation flew three times as many hours as the airlines, and business flying alone flew about a million more hours than the airlines. Of all the movements that are registered by the traffic control towers of the CAA, only one-third are airline movements. The others are private flying, business flying and military. I'd like to quote from a statement given by Secretary Weeks at a dinner of the Traffic Association of the Traffic Club of New York, on February 16th. He said that during 1955, 'CAA control towers handled 19,600,000 landings and take-offs. This represented a 10 per cent increase over 1954, which, in turn, was a seven per cent increase over 1953. This tremendous expansion of air commerce makes safety a major problem now confronting us.' Secretary Weeks had the reports furnished by the CAA control towers, of which there are only 180. However, there are over 6,000 airports in the country; no one knows what their traffic is!

"In addition to this increasing traffic, the airspace itself is shrinking. This shrinkage is due to the use of the airspace by the military services for training purposes, for research, for atomic energy and many other phases of national defense operations. It means that we're flying more and more trips in less and less airspace.

"Another point to think about is that we're just on the threshold of this air traffic problem. In addition to the items that Capt. Christenson mentioned, the gradual increase in current traffic, there is the impending penetration of the short haul air transport market with the introduction of steep gradient type of aircraft or vertical lift aircraft. This should be here within the next 10 years—they will have problems of their own from the point of view of traffic control. They will interfere with the other traffic and vice versa.

"I'd like to point out another important phase of non-airline operations, crop dusting. Few people realize that agricultural flying may be economically as important to the nation as the airline industry. The farmers profit to the extent of about $3,000,000,000 a year from agricultural aviation. Now, you cannot expect a crop duster to have the same type of equipment for flying across country that you would expect the airline pilot, the business pilot or even the ordinary private pilot to have. Yet he has to go

ROUND TABLE PARTICIPANTS

CAPT. CARL M. CHRISTENSON, director of safety for United Air Lines, served as moderator. He joined United in 1933 and is credited with many notable contributions to aviation safety. He is chairman of ATA's VFR committee.

GEORGE W. CHURCH is chief engineer, aviation dept., Bendix Radio Division. From '44 to '46 he was chief instructor, USAF GCA school. His field is radio and communications design; has commercial pilot's license.

WILLIAM B. BARNES is chief of CAA's planning staff. An airline pilot, he flew with United from '36 to '39; joined CAA in '39 as an air carrier inspector. After military service, he rejoined CAA as chief of scheduled air carrier div.

MERRILL ARMOUR, Washington counsel for AOPA, is a member of the law firm, Armour, Herrick & Kneipple. Joining CAB in 1942, he was asst. general counsel, safety legal division in 1946, and asst. chief examiner, 1947 to '50.

JEAN H. DUBUQUE is executive director of the National Business Aircraft Association and author of many articles on business aircraft operators. He has been active in aviation for over 20 years. He is a member of IAS and QB's.

JEROME LEDERER, "Mister Safety," has been a tireless worker in aviation safety for many years and managing director of Flight Safety Foundation, his bulletins are a vital contribution to the cause of air safety.

CRAIG F. TIMMERMAN, ATA's director of Air Navigation and Traffic Control Div. since 1954, was with CAA from 1937 to 1948 then joined ATA as Chicago regional manager. From 1930 to 1937 he worked for Northwest Airlines.

LT. COL. ORLAND O. SISLER, an M.E. graduate of University of Arkansas, entered the Army Air Corps in 1939. A senior USAF pilot, he heads flight procedures section, flight branch, Directorate of Operations, HQ USAF.

"AIR COLLISION *is our most serious type of accident," says Capt. C. M. Christenson, center, "because gravity is always involved.*

from one place to another. This complicates the problem, but also brings in the thought that future traffic control must leave room for the small operator who can't afford to put expensive equipment in his airplane. As far as possible, we must give him freedom to operate.

"There will be no 100 per cent solution to the collision problem, but that doesn't mean we shouldn't take every possible step to alleviate it. It needs a great deal more analysis to determine where conditions are critical. The ATA and ALPA have done an excellent job in gathering collision statistics. These figures indicate that there are four near misses a day, on the average, involving airline operations. I'd like to read what the overall collision experience has been since 1948 up through the first nine months of 1955. There have been 50 fatal collisions, 73 non-fatal, and 123 total: This includes two air carrier to air carrier, which includes non-scheds, collisions of which one was fatal; 11 air carrier to non-air carrier collisions of which eight were fatal; two air carrier to military collisions of which two were fatal, and 92 non-air carrier to non-air carrier collisions of which 34 were fatal.

"Now these last figures are very important because there is a feeling that the see-and-be-seen concept is still valid in current operations. It undoubtedly is to a great extent, but here we see that there were 92 collisions involving non-air carrier aircraft, presumably the slower type of aircraft used in private flying and business operations. Obviously, the see-and-be-seen principle doesn't always work. And a final statistic is that there have been 16 collisions of which five were fatal between non-air carrier and military.

"There is a formula used by physicists for determining the probability of two molecules in random motion colliding with each other. It varies with the square of the number of molecules, with the size of the molecule and with the velocity. As the number of airplanes increases the collision chance will rise as the square, and as the speed increases it will go up directly. This is true of random operations and people might argue that it wouldn't be true of airways operations. I'd like to point out that we are approaching a sort of random situation in this country. We are getting away from the concept of airways operation to the concept of airspace operations where pilots will fly by direct routes rather than by airways. This brings us closer to the physicists formula.

"There are two problems of primary concern: one is the collision problem in a congested area like New York, Los Angeles and Washington, and the other is the enroute problem. I presume that today we are discussing the enroute problem because a proximity indicator probably would not be practical in a congested area. The pilot would go crazy seeing all the little warnings he would get in a congested area. At any one time around New York, within a 50-mile radius, there are, on a good summer day, about 150 aircraft. That was last year, and it will increase as years go on.

"A proximity indicator will be useful primarily for enroute collision prevention. From the point of view of economics, a proximity indicator also would be very useful since it could enable airplanes to fly at closer intervals under IFR conditions. From that point of view alone I think that there should be a great effort made to get a proximity indicator built. I'm very much concerned that the process of designing one has been so slow. I've been trying to push this myself—over the last three years. Frankly, I have gotten nowhere. Perhaps this meeting will stimulate production of a proximity indicator. I might quote from Atkins of NWA who has developed an anti-collision light of considerable promise. He says that 'A Cub coming in through your windshield can ruin your whole day!' "

Capt. Carl Christenson: *"Thank you very much, Jerry, you've given us a little insight into some of the problems we're confronted with in respect to the collision problem. Perhaps Colonel Sisler can give us some idea of the military problem."*

Lt. Col. Orland O. Sisler (*United States Air Force*): "I'd just like to say that I don't have Air Force policy on this. I'm speaking as Sisler and out of the limited experience I've had on SC-74. I feel that we do need a proximity indicator for prevention of collision. We need, as Mr. Lederer pointed out, to get a start on this. And even if we get something that isn't perfect to begin with, the experience we'll obtain from the use of it should enable us to build an ultimate or desirable system. In the Air Force we have several types of airplanes, small, slow aircraft, large aircraft, and very fast aircraft. There's some question about the application of a proximity indicator. Our people are looking into that situation now, but no definite policy as to whether we will or will not buy a proximity indicator or will develop one has been announced."

Capt. Carl Christenson: *"Thank you, Colonel. We have with us Bill Barnes of the CAA. Perhaps he can enlighten us on some of his thinking."*

William B. Barnes (*Civil Aeronautics Administration*): "I've been very interested in what you gentlemen have had to say. I didn't come here prepared to go into all facets of this problem, but I, personally, think that, depending on the definition, we do need a proximity indicator. If it is just a pure warning device indicating that there is another aircraft near you, I'm not so sure that we want it. The device should give more than warning. It should give some intelligence as to direction and possible courses of action to avoid a collision.

"Now, I realize that there is a lot of work that needs to be done on this problem. The work done by CAA has been limited by necessity. A number of you gentlemen, I know, were at the Mid-Air Collision symposium at Indianapolis last fall. One of the papers presented there by Mr. Howell of CAA was significant in helping to establish what is needed. He reported on a study conducted by CAA with the cooperation of some 60 airline pilots. Relatively slow, DC-3 type aircraft were used. The pilots were divided into two groups, one called 'uninformed' and the other 'informed.' The uninformed were simply asked to fly the airplane. Another airplane deliberately flew collision or near collision courses with the test aircraft. The time interval before the uninformed pilots detected the other aircraft on a near collision course was measured. The informed group was told the objective of the study. They knew there would be aircraft on collision courses. But the average detection time curve was almost identical for both groups.

"To me this study has real significance. It's a warning

(Continued on page 34)

"TWENTY SECONDS *seems to be the average time to clear the hazard point after the pilot's decision," notes George Church, right.*

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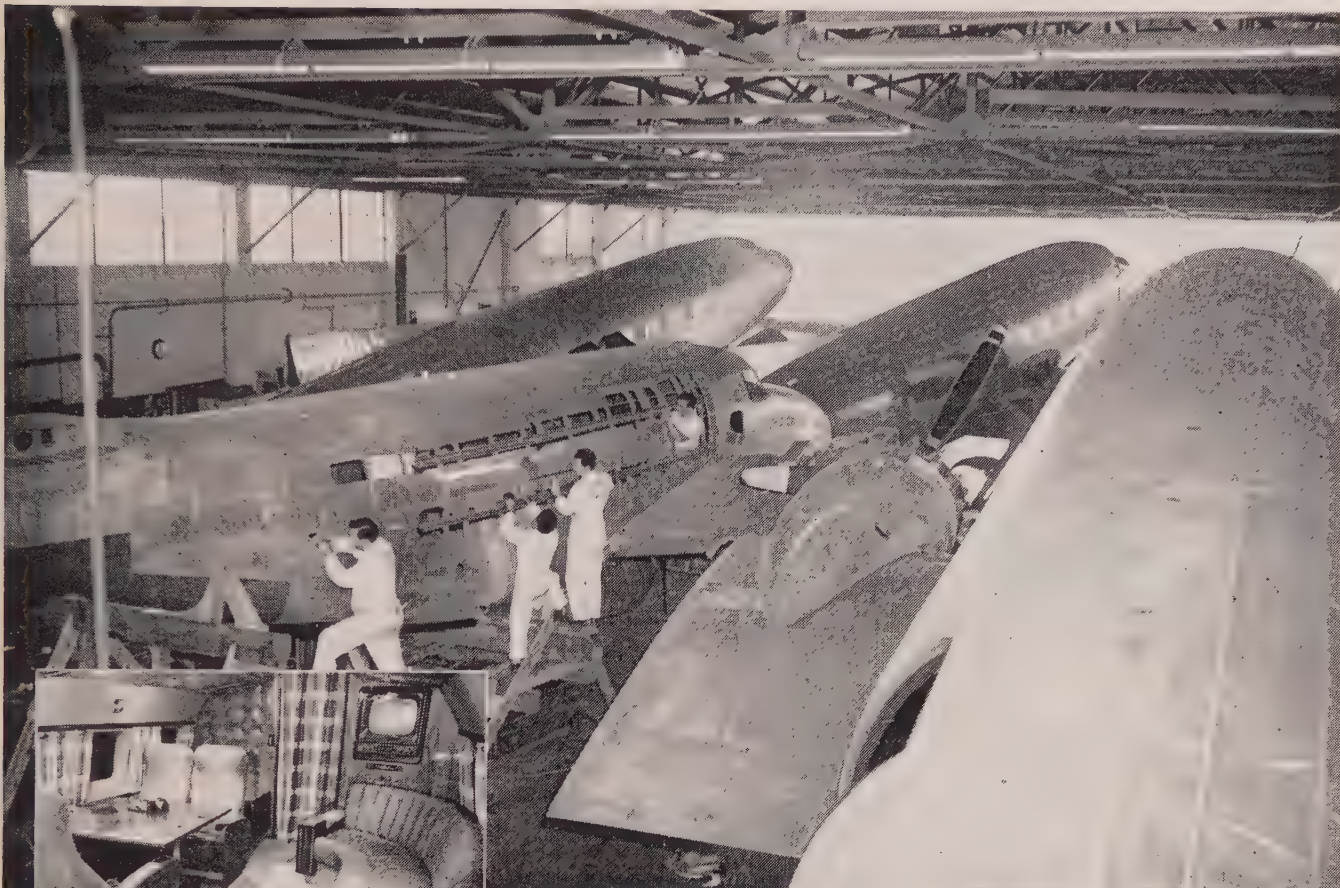

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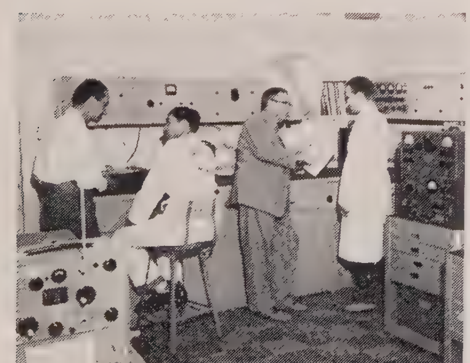

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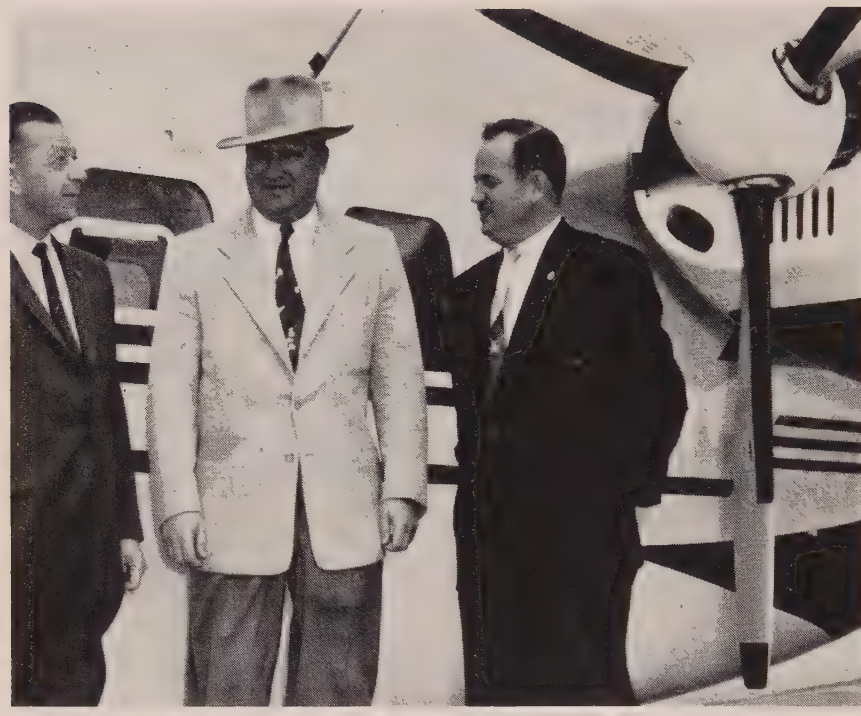
SKYWAYS FOR BUSINESS

News Notes for Pilots, Plane Owners Operating Aircraft in the Interest of Business



AERO COMMANDER *Model 680 and (L to R) C. R. Grey, Long Manufacturing Co.'s chief pilot, R. T. Amis, Jr., Aero president, and Gene Hudman, Stonnell & Holladay Sales.*

First Supercharged Aero Commander To Long Manufacturing Company, Inc.

Bethany, Okla. The first supercharged 260-mph Aero *Commander* Model 680 was delivered here recently to the Long Manufacturing Company, Inc., Tarboro, N. C., by R. T. Amis, Jr., president of Aero Design and Engineering Co.

The Long Company, manufacturers of tobacco harvesters and hay balers will use the new *Commander* for executive transportation in purchasing manufacturing material and to expedite their sales work.

Hertz Corp. Says Airport Business Important Factor In Biggest Year

Chicago, Ill. The Hertz Corp. reports that automobile rental facilities at airports was a factor in a 112% increase in its net income for 1955, the most profitable year in the firm's 33-year history.

Hertz System service is now available at 227 airports, an increase of 64 over 1954. New concessions include the ones at Miami International, Detroit Willow Run, and Flint airports, and at Chicago O'Hare.

Aero Commander 560A Added To Douglas Executive Plane Fleet

Oklahoma City, Okla. Douglas Aircraft Co., Santa Monica, Calif., recently announced through the Aero Design and Engineering Co. that it has purchased a 1956 Aero *Commander* 560A for its executive aircraft fleet.

Frye Safari Expected To Carry Twice DC-3 Load At A Lower Unit Cost

Ft. Worth, Tex. Performance and engineering data on the planned Frye F-1 Safari transport indicate that it is expected to carry double the load of a DC-3 at a lower unit cost.

Jack Frye, founder and president of the aircraft company has said that the high-winged four-engined F-1 will carry 51 passengers on average flights with a direct operating cost as low as .0133 cents a seat-mile compared with .022 cents for a standard DC-3 with the same seating capacity.

Frye will offer the plane in four versions; all cargo, combination passenger-cargo, passenger, and executive-utility. The latter will have custom interior and furnishings easily removable for convertibility to company workhorse.

While basic powerplant will be 600-hp Pratt & Whitney S1H1-G Wasps, nacelles and structure are designed to use other engines up to 820 hp, or the Lycoming T53-L-1 turboprop. Lowest-priced, all-cargo version will cost approximately $365,000.

NBAA Has Special Report On Jets

Washington, D.C. The National Business Aircraft Association has just released to its members a 12-page report on military jet use of bases and civil airports near populated areas.

Fletcher Designs Executive Version Of Its FU-24 Agricultural Plane

Pasadena, Calif. Fletcher Aviation Corp., manufacturer of the FU-24 agricultural plane, has announced a new design which will make the plane a five-passenger or 1,500-pound cargo craft.

The passenger compartment will fit into the area now taken up by the hopper, and will have a canopy-top door. Two forward-facing seats will be permanent, while two rearward-facing seats will fold for lashing to the back wall of the pilot's compartment.

The Continental 6-470-E, six-cylinder, 225 hp engine now used in the FU-24 will remain standard. Fully loaded at the CAA-certificated 1,630 pounds, it takes off at 52 mph, climbs at 625 fpm, and cruises at 110 plus for a 410-mile range.

No firm price has been set for the executive model.

SIKORSKY S-55 *shows how emergency water landings can be made with quickly-inflated donut-type floats. Nose floats are planed for taxiing. System weighs 170 lbs.*

Narco Chief Likes Rain At New Plant Ground Breaking

Ambler, Pa. Ground-breaking ceremonies for Narco's new plant in the Fort Washington Industrial Park near here were held recently on a rainy, soggy day. Although his planned arrival was canceled and ceremonies were moved inside, Narco president, James Riddle, observed cheerfully, "It's weather like this that's making sales jump for airborne equipment."

Pennsylvania's secretary of commerce, Edward G. Davlin was the principal speaker for the occasion.

The new plant will more than double Narco's production facilities. It is being built on a six-acre tract two miles from Wings Field.

Civil Air Regulations And Reference Guide Book For Mechanics Just Out

Los Angeles, Calif. The 13th edition of "*Civil Air Regulations & Reference Guide For A&E Mechanics*" has just been released by Aero Publishers, Inc. The 120-page manual is for students and A&E's.

Miami Firms Get Certifications For Transport-Executive C-46 Conversions

Miami, Fla. Air Carrier Engineering Services and L. B. Smith Aircraft Corp., both based at Miami International Airport, reported receipt of transport category certification for their modification of the C-46.

Now called the C-46/CW20T, the plane has been modernized, and will be available for all types of scheduled airline and executive operations.

The conversion is powered by 2,100 hp Pratt and Whitney R-2800-C series engines which lift an authorized 47,650 pounds take-off weight and will give 1,800 bhp up to 8,000 ft. mean sea level.

Forney Company About Ready With All-Metal 'Aircoupe' For Business

Fort Collins, Colo. The aviation division of the Forney Manufacturing Co. which obtained the manufacturing rights to the old Engineering And Research Corp.'s *Ercoupe* last year, has announced that their all-metal and considerably modernized "*Aircoupe*" will soon be ready for the business market.

Forney says that the first five production models, scheduled off the assembly line within 30 days will be absorbed by the company's sales organization.

Company test pilots report that the new plane will cruise at 120 mph for a 700-mile range with an 18,200-ft ceiling.

The 90 hp (Continental), 2½-passenger—there's a "kiddie seat" behind the right seat—plane will cost around $5,000.

Correction

Winona, Minn. Van's Air Service, Inc. moved its entire operation to new facilities here. SKYWAYS regrets an error in a March-issue item about Van's.

.... in the business hangar

• The Noland Company brought their *Lodestar* into Piedmont Aviation, Winston-Salem, N. C., for a 100 hour inspection. Chief pilot and NBAA representative for Noland is Karl Styne.

• Chief Pilot Sandy DeRengo, recently flew Pope and Talbot's Beechcraft out of Grand Central Aircraft, Co., Glendale, following a 1000 hour inspection, overhaul of engines, and installation of two ARC 15D, one ARC CD-1, and one RT-18/ARC1 system and other miscellaneous work. DeRengo returned the aircraft to its San Francisco base.

• One of Minnesota Mining & Manufacturing Co.'s DC-3's was in to Northwestern Aeronautical's hangar recently for 8000 hour inspection, 1830-94 conversion, installation of wheel well doors and wing tanks, modification of co-pilot's bulkhead and a new interior. Don Richardson is chief pilot and NBAA representative for "3 M."

• Walter E. Bullington, pilot for Refinery Engineering Co., Tulsa, Oklahoma, recently sent in one of his Lycoming engines to Dallas Airmotive, Inc., for overhaul.

• The D. D. Feldman *Learstar* is back in service following installation of Lear radome and Bendix X-Band radar at Lear Aircraft Engineering Division, Santa Monica. John Rich is Feldman's chief pilot.

• Container Corporation's B-23 has been in to Skymotive, Chicago, for special interim modifications, landing gear overhaul and control surface recovering.

• Charlie Bolton and Truman Moses recently brought Unio Chemicals & Material Corp.'s DC-3 to Executive Aircraft Service, Inc., Dallas, for miscellaneous repairs.

• In preparation for a two month European tour, Koppers' DC-3 was at Reading Aviation Service, Inc., recently for major radio and airframe modifications. Collins 18-S-4 and a Loran system were installed. Chief Pilot and NBAA representative Byron Q. Van Cott flew the North Atlantic via Labrador, Greenland, Iceland and Prestwick at the end of March.

• East Coast Aviation Corp., Bedford Airport, Lexington, Mass., has relocated into new facilities at the field. In addition to these new facilities, East Coast is engaged in a quarter million dollar expansion program.

• Roscoe Turner Aeronautical Corp., Indianapolis, installed a Collins NC101 Navigation System, Collins dual omni, glide slope receiver and marker beacon; Sperry gyrosyn system and electric horizon; Wilcox 440B communication system; Lear L-2 autopilot and LVTR-36, and a complete Scott oxygen system in Ebco Manufacturing Co.'s recently purchased Super 18 Beechcraft.

• Malco Refineries, Roswell, N. M., have bought Brown Container's *Lodestar*. John Lyon, Malco's chief pilot and NBAA representative, recently flew the plane to Pacific Airmotive Corporation's aircraft division, Burbank, for a double engine change, auxiliary fuel tanks, 100 hour inspection, complete repaint, gear overhaul, tank reseal and installation of Winslow full-flow oil filters.

• A Flite-Tronics MB-3 marker beacon receiver was installed recently in the Henry Black Drilling Co.'s Beechcraft D-18. Purchase was made from the Continental Radio Company.

• Servel's Twin Beechcraft had a Sperry C2 gyrosyn compass, Flite-Tronics marker and Bendix OmniMag and RMI installed at Remmert-Werner, St. Louis. William Thorson is chief pilot for Servel.

• Husky Oil Co.'s recently acquired B-25 was brought to Spartan Aviation Service, Tulsa, for 100 hour inspection and fuel tank repairs.

• Piedmont Aviation recently completed an interior and exterior paint job for Champion Spark Plugs' DC-3. The ship was brought in by Kenny Colthorpe, Champion's chief pilot and NBAA representative.

• Vernon Edwards, pilot for Tecon Corporation, recently had Dallas Airmotive, Inc., overhaul his Lockheed *Lodestar's* Wright R-1820 engines.

• Russell Purchase, pilot for Dow Chemical Co., Midland, Michigan, brought the firm's DC-3 to Executive Aircraft Service for the installation of a Janitrol heater and new fuel tanks. The -3 also was given a 100 hour inspection and was relicensed.

• Piper Aircraft Co. recently sent an *Apache* to Reading Aviation Service, Inc., for installation of dual ADF, a Lear marker beacon receiver and a rotating beacon. The *Apache* is to be shipped to the C.A.A. in New Zealand.

• Murray Corp. of America's DC-3 is back in service after installation of X-Band radar, Janitrol heater, wet wings, wheel well doors, 13-inch oil coolers, minor cowling and other work at Pacific Airmotive, Burbank. The -3, based at Detroit, is flown by E. C. Spencer, who also is his company's NBAA representative.

• Abitibi Power and Paper Company of Toronto's new Remmert-Werner DC-3 has a Bendix RDR-1B1 airborne X-Band radar installed with Racon beacon and ground mapping facilities and Remmert-Werner laminated one-piece radome.

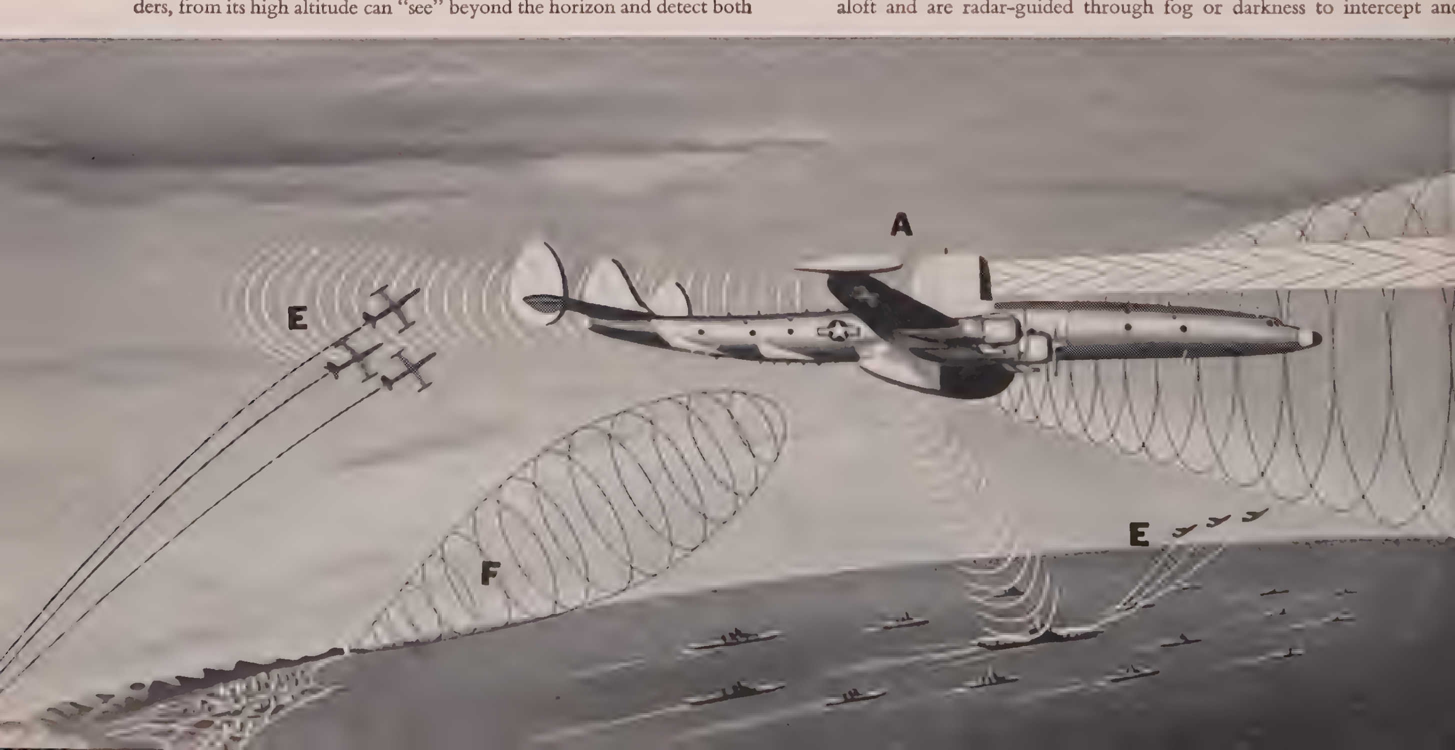
• Pocahontas Fuel Company's Beechcraft D18S was flown into Piedmont Aviation by Chief Pilot Bob Amundsen for 100 hour inspection and double engine change.

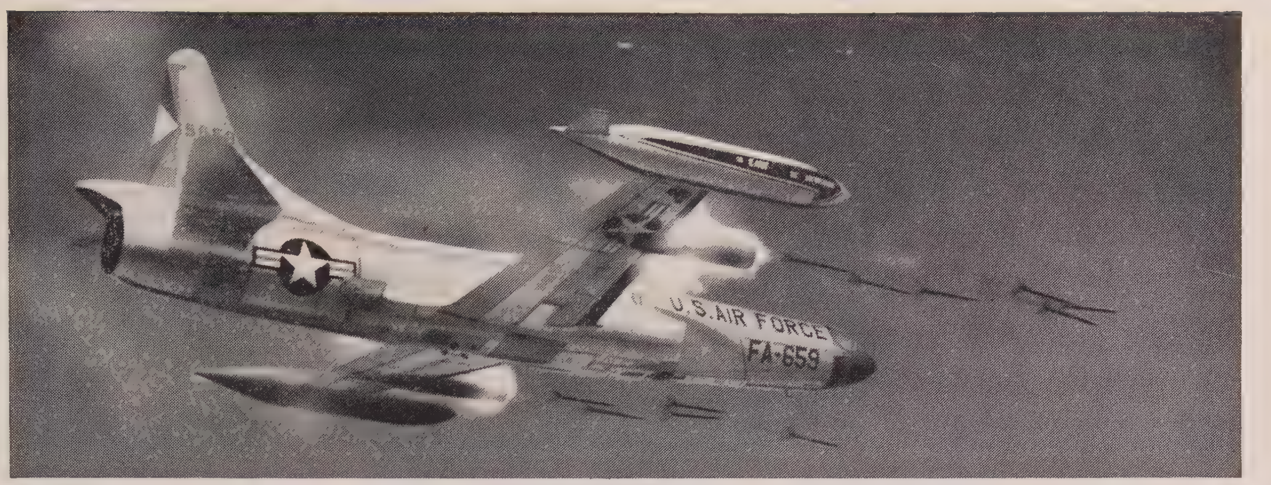
• Bob Harlow of Transcontinental Gas Pipeline Co., recently brought the company's PV-1 to Spartan Aviation Service for 100 hour inspection.

New U.S. Concept for
TOTAL DEFENSE

In this age of awesome airborne nuclear weapons, a vast umbrella of airborne electronics will safeguard our nation against sneak attack

BELOW—A WEAPONS SYSTEM IN ACTION. An electronics-laden Super Constellation early-warning plane (**A**), patrolling our outermost defense perimeter hundreds of miles from our shores and borders, from its high altitude can "see" beyond the horizon and detect both high-flying and low-flying enemy aircraft (**B**). Using its powerfu search radar (**C**) and height-finder radar beam (**D**) to pinpoint positio of invaders, the patrol plane alerts our interceptors (**E**), which swarn aloft and are radar-guided through fog or darkness to intercept an



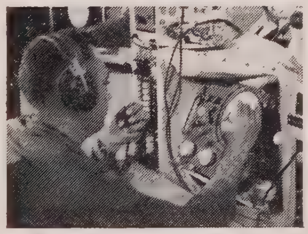


LEFT—EARLY-WARNING RADAR PATROL. Designated the WV-2 by U.S. Navy and EC-121 by USAF, these radar-domed Lockheed Super Constellations carry six tons of electronics and a 31-man crew. Super Constellations are ideal for this duty because of their famed all-weather stability and extremely long range.

ABOVE—ROCKET-FIRING STARFIRE INTERCEPTOR. First of the almost-automatic all-weather interceptors, the Lockheed F-94C Starfire is an example of Lockheed's leadership in the design and development of airborne electronics. This deadly defender and other interceptors will soon be supplemented by—

Farsighted Pentagon planning and recent amazing technological developments by U.S. science and industry are rapidly making our nation's TOTAL DEFENSE system the most formidable in all history.

Lockheed's role in implementing our new Weapons System concept and in Systems management, is an important one. Thousands of Lockheed military aircraft, of *nine* widely different types, are already in service. Other advanced planes, missiles and electronic guidance devices are in production, undergoing tests or on the drawing boards at Lockheed. And Lockheed's pioneering leadership in design and development of airborne electronics will continue to contribute heavily to TOTAL DEFENSE.



STILL-SECRET F-104 SUPERSONIC JET FIGHTER. (Photo not yet released.) A high-ranking USAF officer said of the F-104: "This is a fighter pilot's dream. We feel confident that it is the fastest, highest-flying fighter in the air, anywhere."

THREE PHOTOS AT LEFT show crew members of Super Constellation early-warning plane at work. (Top) Navigator plotting a fix; (center) observers at radar consoles plotting altitude, speed and course of unidentified aircraft; (bottom) fighter-director charting position and path of approaching aircraft.

Lockheed

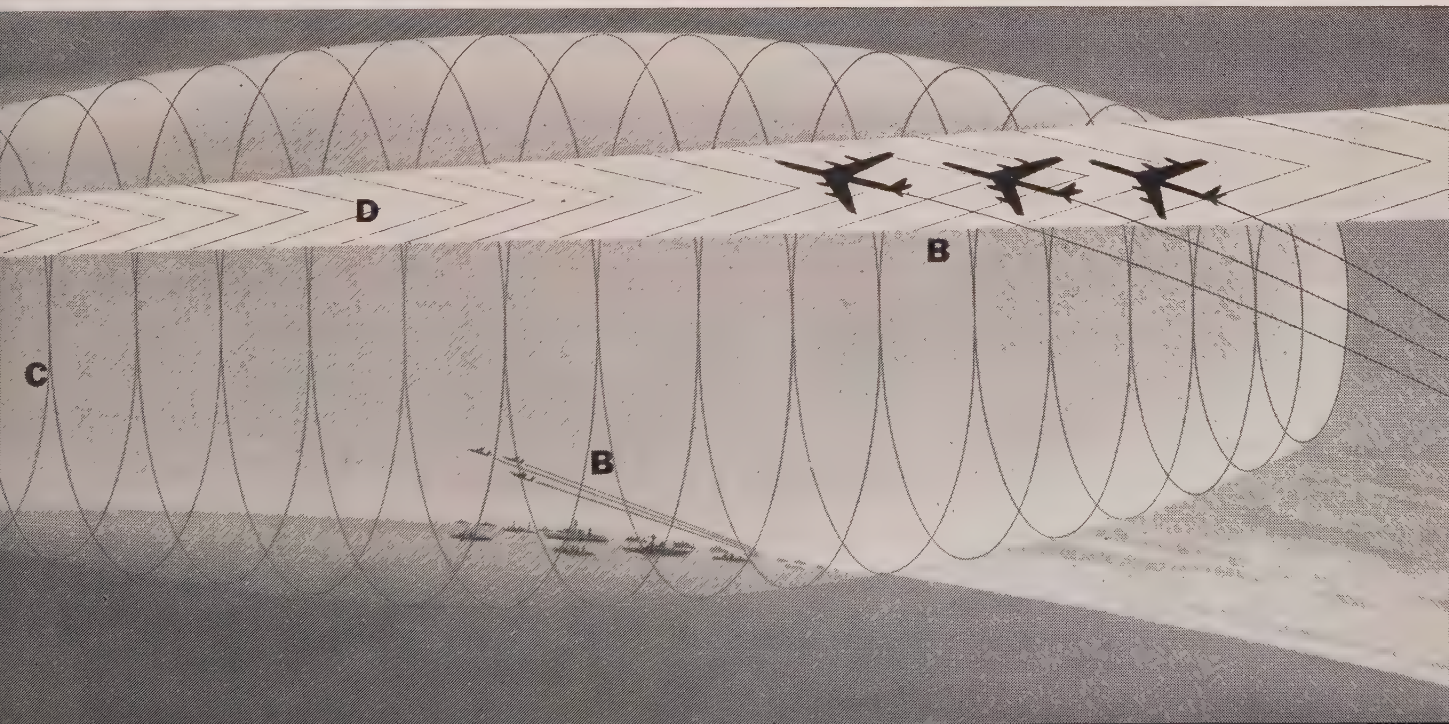
AIRCRAFT CORPORATION

California Division, Burbank, Calif.
Georgia Division, Marietta, Ga.
Missile Systems Division, Van Nuys, Calif.
Lockheed Air Terminal, Burbank, Calif.
Lockheed Aircraft Service, Burbank, Calif.

LOOK TO LOCKHEED FOR LEADERSHIP

A CAREER IN MILITARY AVIATION ASSURES A FINE FUTURE FOR YOUNG MEN OVER 17. SEE YOUR NAVY OR AIR FORCE RECRUITING OFFICER.

stroy the attackers with high-speed rockets or missiles. Any enemy craft penetrating our barrier patrol areas would be detected by shore-sed radar stations (**F**) and Ground Observer Corps outposts contin-usly manned by patriotic civilians helping to keep our nation free.



Navigation NAVICOM Communication

Procedures, Regulations for Navigation, Communication in Flight Operations

Kollsman Has Integrated Flight Instrument System

The first Integrated Flight Instrument System, a significant step toward solving the problem of altitude separation, cruise control and dead reckoning, has been developed by Kollsman engineers. For the first time, pilots are given *interrelated* flight data which are more precise and more complete than any available to date. The system features greatly increased altimeter accuracy to provide precision in altitude separation. Douglas Aircraft Co., Inc., have announced their acceptance of the instrumentation for use in the DC-8 aircraft.

The Kollsman Integrated Flight Instrument System consists of three pressure instruments—a sensitive altimeter, a standard indicated airspeed instrument and a Machmeter. The System also includes an angle of attack sensor, an outside air temperature probe, and a computer. By means of servo components the instruments are interconnected to each other and to the computer. Information signaled from one instrument is used to correct the data of other instruments.

The important advantage of the system is that while it depends on conventional pressure instruments which are connected electrically to each other and to a computer, each can function independently. By means of the electrical connections, standard indications are made considerably more accurate and new information is secured. In the event of electrical interruption, the pilots continue to receive pressure readings so that indicated and maximum allowable airspeed and Mach number are not affected, while altimeter indication reverts to its normal pressure accuracy.

The nucleus of the System is an altimeter which has a new high accuracy with realistic errors of not over 50 feet at sea level and 100 feet at 40,000 feet. Designed for easy readability, the altimeter registers thousands of feet on a counter or drum, and shows hundreds of feet with a pointer.

Airspeed is indicated on the familiar pressure instrument with a range of 60 to 450 knots. Minimum safe speed for approach and landing, and most efficient cruising speed are represented on a colored arc which moves around the rim of the dial face. Maximum allowable airspeed for the entire range of the aircraft is shown by a striped pointer, and indicated airspeed, by the main pointer. True airspeed is presented separately on an easy-to-read digital counter type dial eliminating involved computations.

The Kollsman Machmeter, which is corrected for installation error, gives a continuous indication of Mach number and has a range from 0.3 to 1.0 Mach number and from sea level to 50,000 feet.

True outside air temperature is indicated directly. Previously, even to approximate the true reading, pilots had to apply corrections to the indicated outside air temperature. In addition, the system can provide remote true airspeed and true outside air temperature for the navigator.

Although there are only five sensing units, each one carries out more than one function. For example, both Mach number and angle of attack data are fed into the altimeter to correct for the inherent error in the aircraft's static pressure system. To correct for instrument error, information from the altimeter is servoed to the computer where it is acted upon by a scale error corrector and the precise correction is fed back to the altimeter. Moreover, by combining Mach number with outside air temperature, true outside air temperature and true airspeed are obtained. Information from the angle of attack sensor is fed to the airspeed indicator where the minimum safe speed and most efficient speed are presented.

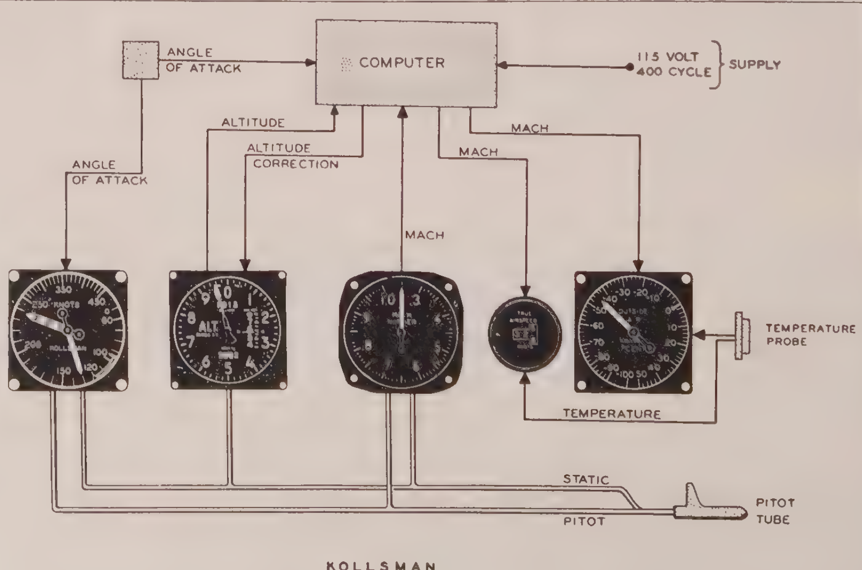
The development of the Kollsman Integrated Flight Instrument System is considered one of the major contributions to commercial aviation in recent years. Although designed primarily to meet the critical demands of jet transports, it is equally well suited to *every* type of high performance aircraft. The present active interest in the system points to wide acceptance by manufacturers and all users of high performance aircraft.

VHF-FM Radio Designed For Business Aircraft

The Communications Company, Inc., of Coral Gables, Fla. has announced their new Model 400-12/24 FLIGHTCOM VHF-FM aircraft radio, designed for executive and utility aircraft used by power, petroleum and other industrial operations. Many are also used successfully in helicopters.

Two principal frequency bands are most often used for these applications; namely, 25 to 54 and 144 to 174 mc. The latter band is considered better for short-range operation, providing 10 to 15-mile communication ranges between base stations and land mobiles. The lower frequencies are better suited for communication over greater distances, up to 50 miles.

VHF-FM, like VHF-AM in the 108 to 132 mc aeronautical navigational and communication band, has a range approximately equal to line-of-sight distance; however, FM communication equipment *is not nearly so susceptible to interference* from aircraft ignition,



KOLLSMAN
INTEGRATED FLIGHT INSTRUMENT SYSTEM - KS-86

generator noise, or man-made static. FM equipment installed in aircraft having no shielding or bonding whatsoever will furnish excellent communication over distances up to 100 miles. Also an FM transmitter designed for aircraft service will have a much better watts-per-pound ratio, since the transformers and other components required for the AM modulator are eliminated in the FM transmitter. Further, for an equivalent power supply, approximately three times as much transmitter power output can be delivered to the antenna by the FM transmitter.

Being fixed frequency, with no manual tuning required, the unit may be mounted in the baggage compartment or other suitable location aboard the aircraft any distance from the cockpit. The only controls necessary for the pilot are off-on switch, volume and squelch controls. The installation, (less speaker, antenna and battery cables), weighs 20 lbs complete with shock mounts, microphone, and control box with control cables.

The FLIGHTCOM equipment is certified with the Federal Civil Defense Administration for the matching funds program and is on the FCC "list of equipment acceptable for licensing."

Overall size of the chassis case is 14 x 11.5 x 6.5 inches. The single unit is easily removed from its case for inspection or servicing and can be removed and replaced with a spare unit in less than one minute, since no changes are required in the unit when changing from a 12 to 24 volt aircraft.

The pilot's control box incorporates an On-Off switch, indicator lights, volume and squelch controls and frequency selector switch for dual-frequency models. Connecting cables are supplied in lengths as specified by the customer. Provision is made for two headphone jacks for pilot and co-pilot. There is also a speaker plug on the rear of the control box. The FLIGHTCOM unit is mounted on an ATR type shock mount. (Not standard size.)

Standby drain of the complete unit on 12 volts is 4.5 amperes and 10 amperes while transmitting. On the 24 volts, the standby is 2.5 amperes, transmitting 5 amperes.

A differential noise-canceling hand microphone is normally furnished with the FLIGHTCOM package. A military type combination headphone/microphone assembly with lipmicrophone can be furnished on special order for helicopter operation where it may be difficult for the pilot to operate a hand held microphone. For larger, multi-engine executive aircraft, a remote operating position may be desired in the cabin.

When required, the COMCO FLIGHTCOM models can be furnished for dual-frequency operation (frequency separation of the two channels not to exceed 500 kc). The antenna is not included with the FLIGHTCOM package as the antenna selected is dependent on the frequency band and aircraft type.

Power output of the transmitter is 35 watts for the 25-54 mc unit, 25 watts for the 144-174 mc unit, with a frequency stability of .005 per cent (.002 per cent with a temperature-controlled crystal available). A long life, non-synchronous vibrator is used in the power supply in combination with a 12/24 volt power transformer and associated filter system.

The receiver is a crystal-controlled, dual conversion superheterodyne type designed for FM reception on the 25-54 mc and 144-174 mc bands. They operate from a 52 ohm antenna input and deliver one watt of undistorted audio output into a 4 ohm speaker or 500 ohm output optional for headphones.

Prices start at $515.00.

Air-Aids Spotlight

ALASKA BOUND FLIGHTS—BARTER Is., B. C. *Radio Beacon decommissioned;* SITKA *LFRange frequency changed to 344 kc.*

ATLANTA, Ga.—*All aircraft landing Atlanta should make initial contact with Approach Control regardless of weather, preferably on 120.7 mc; else transmit common calling, listen 120.7 mc.*

ATLANTIC CITY, N. J.—*Navy installed TVOR on field, frequency 115.0 "NBB."*

BALTIMORE, Md.—*VOR to be shut down last half of month of May.*

BEDFORD, Mass.—*Air Force GCA facility available as primary aid due to efforts of Mass. Aero. Comm. Frequency 118.9 mc, will also guard 122.5 mc and 3023.5 kc.*

CARLSBAD, N. Mex.—*BVOR to resume operation on 116.3 mc.*

CHEYENNE, Wyo.—*ILS Localizer to resume operation on 109.9 mc, Glide Path on 333.8 mc.*

CHICAGO, Ill. — *Navigational and approach facilities serving MIDWAY changing identification to "MDW" (LOM—"MD," LMM—"DW").*

COCHISE, Ari.—*VORW to resume operation on 117.7 mc.*

DENVER, Col.—*3 million candle power experimental approach lights at approach end Runway 17. Contact tower to turn on or off.*

DOVER, Del. — *LFRange recommissioned same frequency and location. Courses 053° A 134° N 233° A 314° N (inbound).*

EMPORIA, Kan.—*BVOR to resume operation on 112.8 mc.*

FORT SMITH, Ark.—*ILS & ADF approach recommissioned. See AirGuide for minor changes in Glide Slope altitudes, pull-out and mininums.*

GREENSBORO, N. C. — *ILS Glide Slope and Middle Marker out until end of June.*

GREENVILLE, S. C. — *ILS Glide Slope use approved to Middle Marker only; altitude over LOM 2188', over LMM (201 KC "RL") 1213'.*

INDIANAPOLIS, Ind.—*Enroute Radar Control service test in operation vicinity of TERRE HAUTE (0700-2300 Mon-Fri) identifying call "ROCKVILLE CONTROL" primary VHF frequencies 125.3 mc, alternate frequencies 121.5, 122.1(2), 126.7, 135.0(.9).*

JACKSON, Tenn.—*BVOR commissioned "MKL" 115.5 mc on V-16, NASHVILLE-MEMPHIS.*

KANSAS CITY, Mo.—*KANSAS CITY Tower frequency now 299 kc.*

LONDON, Ont.—*ILS resumed operation on 109.5 mc, LOM on 382 kc, both "XU."*

LOUISVILLE, Ky.—*VOR approach circling mininums reduced to 700'—1½ mi.*

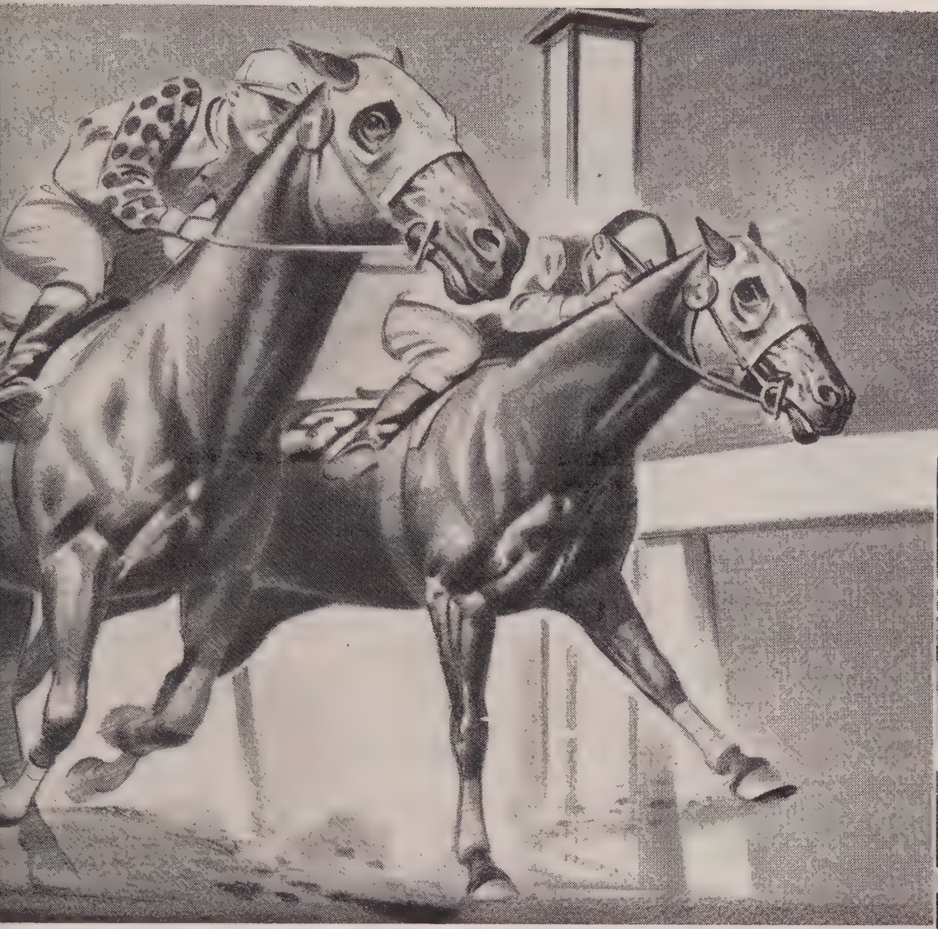
MEGANTIC, Ont.—*North/South legs LFRange now 191°/011°.*

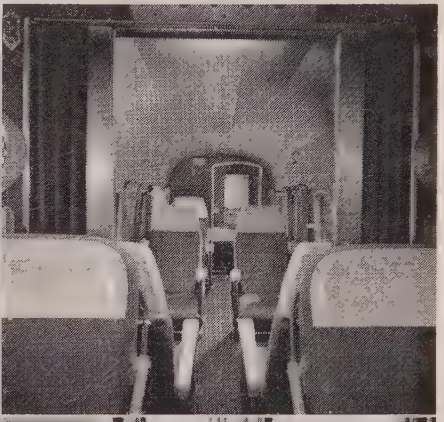
MIAMI, Fla.—*Tower guards 122.7 mc now instead of 122.5 mc. Radio beacon commissioned on 209 kc "TMT" at TAMIAMI Intersection Blue 3.*

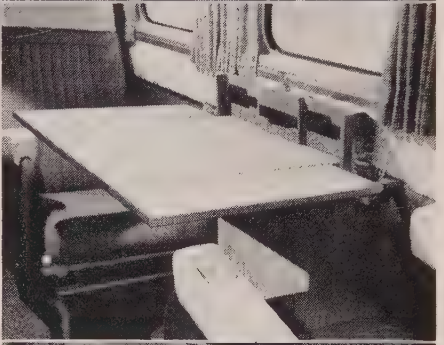
PALACIOS, Tex.—*BVOR shut down until middle of June.*

RAPID CITY, S. D.—*BVOR/DME being relocated 4 miles SSE of Runway 32.*

SPRINGFIELD, Ill.—*Approach Control commissioned.*



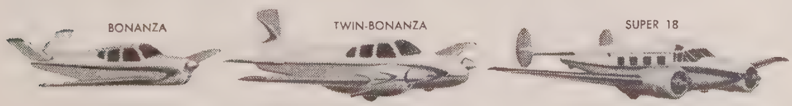




AND BUSINESS, TOO!

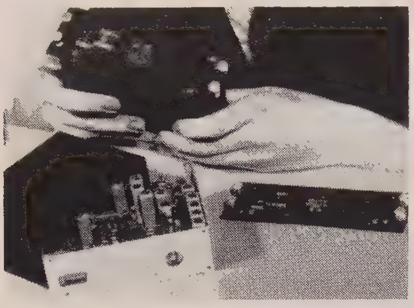
Join hundreds of BEECHCRAFT SUPER 18 owners at the Kentucky Derby — *and yet not lose one minute from your busy work-week!* Travel in luxurious comfort at 215 miles-per-hour *direct* to Louisville, just like on your everyday business schedules — which you make yourself with your own Beechcraft Super 18. Convenient fold-away tables provide facilities for work to be done enroute. Picture-window visibility in the Super 18 reveals all the beauty of flight in your own personal transport. Easy-entrance stairs and interior walk-around comfort guarantee the ultimate in relaxing, worry-free travel. More than three times as many Beechcraft 18s have been purchased by progressive businesses as have any other twin-engine executive airplane! These owners ***know*** they can enjoy the finer things in life and still save up to 75 per cent of their travel time with a Beechcraft Super 18 Executive Transport.

Beechcraft



BEECHCRAFTS ARE THE AIR FLEET OF AMERICAN BUSINESS

First All-Transistor Marker-Beacon Receiver



The first all-transistor electronic marker-beacon receiver, a flyweight 15-ounce navigational aid, has been developed by the Radio Corporation of America. The new marker-beacon receiver is the smallest and lightest ever developed and requires only three-quarters of a watt, or less power than is needed to light a standard flashlight bulb. The wattage requirements of tube-type receivers are many times greater.

Electronic marker-beacon receivers are used to provide pilots with positive "guide-posts" in navigation and in landings under instrument conditions. They tell the pilot by visual and/or aural signal when he is over airfield and airlane marker-beacon transmitters on the ground in identifiable locations.

The RCA transistorized marker-beacon receiver measures only two inches high, four inches deep, and five inches wide. In addition to the receiver, the navigational system includes a three-light signal box with identical dimensions and weight. The signal box is sufficiently compact for installation in the instrument panel, or elsewhere in the pilot's cabin, and can be connected for operation with the receiver located in another part of the plane. The combined receiver and signal-box provide a 30-ounce, space-saving package.

The receiver operates on the standard marker-beacon frequency of 75 megacycles and utilizes printed circuitry and a special passive light-switching circuit. The transistor-circuit design makes possible the elimination of electrical relays, normally used in tube-type marker-beacon receivers.

Executive A-26 Crash Tied To Gas Fumes

(CAB Report Abridged)

On October 3, 1955, a Douglas A-26-C, N 67148, owned and operated by the Great Lakes Carbon Corporation, crashed two miles northwest of Union City, Oklahoma, following structural failure resulting from a mid-air explosion. All four occupants received fatal injuries and the aircraft was destroyed.

N 67148 departed LaGuardia at 1346 for Tulsa, Oklahoma, enroute Los Angeles, Cal. After landing at Tulsa the aircraft was re-fueled with 906 gallons of gasoline which filled to capacity both main tanks, the nose tank, *and the rear fuselage tank.* Both auxiliary tanks were full at the time of refueling. After the pilots were briefed by the Tulsa U. S. Weather Bureau office, they filed IFR to Los Angeles via Oklahoma City, alternate Burbank.

At 2114 Oklahoma City Radio received a call from N 67148 requesting cancellation of the IFR flight plan and asked for a landing clearance at Oklahoma City. The Oklahoma City weather was 10,000 feet overcast, sky partially obscured; fog; visibility 1½ miles. The flight was advised to contact RAPCON (Radar Approach Control) on 119.3 mcs. for a clearance to land as IFR conditions prevailed. The crew was requested to advise which airport clearance was desired for and the reply was, "Will Rogers Field." This was the last radio contact with the flight although subsequent attempts to contact it were made by RAPCON.

At approximately 2117 an aircraft, later identified as N 67148, was observed to crash on a farm 2⅜ miles northwest of Union City, Oklahoma, and 23 miles west of Will Rogers Field, Oklahoma City. Two explosions were heard in the air prior to the crash and portions of the empennage and fuselage were found along the last three miles of the flight path.

Disintegration in flight was indicated by numerous segments of the fuselage shell and portions of the horizontal stabilizer skin being found back along the flight path as far as three miles from the main wreckage. The main portion of the empennage was found three-eighths of a mile from the main wreckage. All of the scattered portions of fuselage structure were from the area aft of the cabin rear bulkhead.

Examination of these parts gave evidence of internal explosive forces that had blown the skin outward or off and distorted the structure of all empennage components except the rudder and elevators. The fuselage disintegrated along rivet seams, which are areas of least tensile strength, evidencing a practically uniform internal pressure throughout the aft portion of the fuselage. The aircraft was not equipped for cabin pressurization.

No evidence was disclosed to suggest failure or malfunctioning of the engines or propellers prior to impact.

A 125-gallon fuel tank and radio rack were installed in the aft fuselage *without a vapor seal separating the two units.* It was established that the aft fuselage tank was filled to capacity at the time of departure from Tulsa. The Tulsa fuel attendant stated the tank was not overfilled at the time of servicing.

In the tail section of the fuselage, aft of the rear cabin bulkhead, in addition to the 125-gallon fuel tank, there were installed seventeen major units of radio and electronic equipment.

Facts determined by investigation disclosed that the tail surfaces and fuselage aft of the bulkhead at the rear end of the cabin separated from the airplane in flight.

The manner in which the skin bulged outward and separated from the horizontal stabilizers and bulged outward on the fin could result only from very high internal pressures. It is apparent that the pressures which caused the disintegration built up suddenly and that they originated in the aft fuselage. Only an explosion within the aft fuselage could cause a sudden pressure increase of this nature.

None of the characteristics of an explosion produced by solid explosives, such as dynamite or TNT, were present in the wreckage. Instead, the fuselage disintegration indicated a practically uniform pressure such as is caused by the ignition of an air-gasoline mixture which is much slower than the detonation of high explosives. The Board therefore concludes that fumes caused by leaking fuel were ignited by operation of electrical equipment installed in the aft fuselage.

The nature of the accident and the fact that all communication from the flight were routine and conducted in a normal tone of voice indicate that the pilots were unaware of an immediate emergency. The reason for discontinuing the flight to California and the decision to land at Oklahoma City could not be determined. [See Ed. Note.]

As a result of the investigation the following notification was forwarded to all Aviation Safety District Offices, and to all owners of this model aircraft: "Investigation recent A-26 accident indicates possible fire and explosion hazard in rear fuselage area. For all A-26-B and A-26-C aircraft having rear fuselage tank installed in same compartment with electrical components liable to sparking the following restriction is mandatory until further notice: Rear fuselage fuel tank shall be drained, purged, and marked to prohibit use. Placard cockpit fuel control and filler cap for information pilot and servicing personnel." This notice was followed by AD 55-26-1 which specifies modifications for reactivation of the rear fuselage tank.

[Ed. Note: Although the crew gave no indication of a known emergency condition in their contacts, the abrupt and early decision to terminate the flight gives reasonable credence to the possibility that gas fumes and/or a fuel leak were detected and a precautionary landing decided upon. In this regard, a pilot might be well advised to avoid any further action involving use of equipment that could produce electrical arcing and even consider resorting to the radio failure provision of CAR 60, if at all possible.]

Improper Procedures Fatal To DC-3 Non-Sked

(CAB Report Abridged)

A Currey Air Transport DC-3C, N 74663, struck powerlines during an attempt to make an emergency landing and crashed at the Lockheed Air Terminal, Burbank, Cal., on September 8, 1955. Both captain and co-pilot were killed, the stewardess and one passenger were seriously injured, and the remaining 29 passengers received minor injuries.

Weather at the time of the incident was "partial obscurement, 10 thousand, broken clouds, visibility one and seven eighths miles, haze and smoke, smoke layer 10 thousand." A pilot who had just landed reported that the visibility to the south was worse because of smoke than it was at the airport or to the north, and probably less than 3,500 feet or 4,000 feet forward visibility at the 300-foot level.

This was a nonscheduled flight originating at Burbank, Cal., for Oakland, Cal. Company records indicated that takeoff gross weight was 26,089 pounds (authorized maximum was 26,200 pounds), and the center of gravity of the aircraft was located within prescribed limits. A Defense Visual Flight Rules flight plan was filed. The flight was cleared for takeoff from runway 15, to climb westward on top of haze and smoke. It executed a takeoff and climbed in a normal manner into smoke haze, which was more dense toward the south, and in which it was lost to view of observers at the airport.

Approximately one minute after takeoff the flight called the tower and requested an emergency landing clearance. Runway 7 (ILS runway) was suggested by the tower and accepted by the pilot. The airport was cleared of traffic and emergency equipment alerted. Four minutes later the flight called the tower and stated its intent to land on "Runway 31." Lockheed Air Terminal has no Runway 31 but has a Runway 33.

About this time the flight was sighted by the control tower operator an estimated one mile to the southwest, proceeding in a nose-high attitude toward the airport but not aligned with any runway. The left wing struck a service powerline at the airport boundary. The aircraft stalled, its left wing collided with two parked Air Force C-54's, it cartwheeled, slid across the apron and struck Lockheed Service Hangar No. 24, coming to rest in the open doorway of that hangar. The fuselage broke open at a point behind the wing and most of the survivors escaped or were rescued through this opening.

Examination of the wreckage disclosed extensive damage to all major assemblies of the airframe. This was due to impact with the two other aircraft, the ground, and the hangar. The landing gear was found to be down and locked and the flaps were retracted.

Complete teardown examination of both engines disclosed that: The left engine, except for impact damage, was capable of delivering its power in a normal manner. The right engine had sustained internal damage during operation. The blades of the left propeller were at 32 degrees when impact occurred; those of the right propeller were at 18 degrees.

Examination of the feathering system of the right propeller disclosed an intermittent open circuit in the wire connecting the feathering button holding coil and the feathering pump relay, caused by a loose soldered connection on the holding coil terminal. This condition could have been produced by impact forces that severely damaged the overhead panel upon which the feathering switch was mounted.

Several of the ground witnesses described the engine sound and visible rotation of the propellers as normal for the left but slower and irregular for the right. One competent witness stated that the right prop seemed to be "going in and out of feather." The preponderance of witness testimony indicates that the gear was down and it still was down and locked when the wreckage was examined.

The company's training procedure at Lockheed Air Terminal for single-engine return on instruments starts with pilot already under a hood and on instruments. The procedure starts with a climb to 2,000 feet on a course of 255 degrees (parallel to the ILS leg at Lockheed Air Terminal which is 255 degrees outbound). At 2,000 feet and beyond the Outer Marker he executes a turn toward the leg and the marker, intercepts the glide path and localizer, and completes his approach.

The chief pilot testified that he had used the subject aircraft for a 40-minute pilot qualification flight (of another

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Official NBAA Report

NATIONAL BUSINESS AIRCRAFT ASSOCIATION, INC.

(formerly Corporation Aircraft Owners Association)

National Business Aircraft Association, Inc. is a non-profit organization designed to promote the aviation interests of the member firms, to protect those interests from discriminating legislation by Federal, State or Municipal agencies, to enable business aircraft owners to be represented as a united front in all matters where organized action is necessary to bring about improvements in aircraft equipment and service, and to further the cause of safety and economy of operation. NBAA National Headquarters are located at Pennsylvania Building, Suite 344, 13th & Pennsylvania Avenue, N.W., Washington 4, D.C. Phone: National 8-0804.

NBAA Aircraft Enlisted In Emergency Airlift Plan

The following plan has been prepared by the Defense Air Transportation Administration in cooperation with the Federal Civil Defense Administration and the NBAA. It is the purpose of the plan to use on a national basis the fleet of non-carrier business transport-type aircraft of the weight of the Lockheed *Lodestar*, DC-3, and above, in volunteer National Emergency Defense Airlift (NEDA) operations.

The development of this plan over a period of several years in no way indicates the existence or forecast of an emergency. It does, however, recognize the valuable reserve airlift potential, and the importance of allowing business aircraft to continue their vital function of air transportation in the interest of defense production and a sound national economy, while also providing for NEDA operations in the event of a national emergency.

In addition to the NEDA plan, planning for the use of both scheduled and non-scheduled air carriers has progressed satisfactorily and is designated as the Civil Reserve Air Fleet (CRAF) program, and the War Air Service Pattern (WASP). Additional NEDA plans are being developed for the use of privately owned light aircraft below the weight of 12,500 pounds.

NBAA earnestly requests your comments on the NEDA plan as well as any suggestions you may care to make. Your interest and cooperation are vital to the effectiveness of this plan both in the final organization and in its future implementation.

NATIONAL EMERGENCY DEFENSE AIRLIFT (NEDA) INTERIM PLAN

1. *Objective*

The object of this plan is to make the most effective use of non-carrier transport aircraft in attempting to meet the air transportation requirements of a civil defense emergency. An initial emergency may involve simultaneous attacks on numerous centers in the United States. There will be an immediate requirement for the transportation of doctors, nurses, plasma, medical equipment, etc. to disaster areas. At the same time there will be immediate need for rapid mobilization of all the country's resources, including military personnel and supplies. Every useful aircraft must therefore be employed to meet the total needs of the country.

2. *Coverage*

This plan relates solely to non-carrier transport-type aircraft such as the Lockheed *Lodestar*, DC-3, C-46 and other types with a gross weight of 12,500 pounds or over, and such four-engine aircraft as are not assigned to the CRAF, and not engaged in common carrier or contract carrier operations. Designation of the above category will be *National Emergency Defense Airlift (NEDA)*.

3. *Principles*

a. To be effective in an emergency, planning must be founded upon a nation-wide communications system, fully manned and operated on a 24-hour basis during normal times and involving no major changes in personnel or equipment at the time an emergency may occur.

b. Operations must be conducted under centralized policy established in advance, but with decentralized administration, if necessary, under emergency conditions.

4. *The Plan in Detail*

a. *How it will work*

In the event of attack upon the United States, all aircraft will initially be grounded under the SCAT (Security Control of Air Traffic) plan. This may require a prompt landing at the nearest airport. NEDA aircraft will then notify the nearest airline operations office of their identity, type of aircraft, and state of readiness. The owners or crews of aircraft not in the air at the time will also telephone or convey the same information to the nearest airline operations office.

Meanwhile, the Federal Civil Defense Office will advise the nearest RAPCO (Regional Air Priorities Control Office) of FCDA's requirements for air transportation by passengers and cargo between points of origin and points of destination. The RAPCOs are set up on a standby basis at the 21 key cities which are the communications centers of the airlines; they will transmit these requirements through the airlines communications network to every airline station in the entire area.

While local airline offices will be responsible for dispatching airline aircraft as needed, they will not undertake to dispatch NEDA aircraft. Airline offices will merely transmit information on FCD requirements to all NEDA aircraft that have checked in. Aircraft Mobilization Coordinators, appointed by FCDA will be responsible for coordinating information and directions received from RAPCO personnel and will direct the orderly dispatch of all NEDA aircraft within the regions.

Prior to such emergency, standby contracts and detailed procedures by which Civil Defense traffic will be carried will be arranged by FCDA. Contracts will include coverage of operation and maintenance costs, flight crew salaries and insurance protection. Identification insignia and credentials will also be necessary.

b. *Communications*

Since all available communications systems will be fully loaded with emergency messages and with the dispatching of aircraft, this plan contemplates an absolute minimum use of communications lines.

The time required to match civil air transport availability with specific FCD requirements could result in tremendous additional casualties because of the delay. However, should sufficient communication facilities be available at the time for two-way transmission of requirements and capabilities, the Aircraft Mobilization Coordinator will dispatch NEDA aircraft on that basis. He will, in any case, exercise his best judgment and initiative in directing the operation of all NEDA aircraft to meet as fully as possible emergency civil defense needs.

NBAA is proud of the major role it has played in spark-plugging the "NEDA" plan and will continue to help develop improvements and simplification of its concepts. NBAA also has aided in the design of a special insignia to mount on aircraft to identify participants in the NEDA plan.

USAF-CAA Moving Toward High Altitude Separation

At the recent ALPA Air Safety Forum in Chicago, Col. Lawrence S. Lightner, chief of the Air Traffic Control Branch in the USAF's Operations Directorate, said that the need for positive aircraft separation at high altitudes is "urgent." He revealed that the USAF-CAA plan to control all airspace above 24,000 feet, described by a top Air Force officer recently at a Washington conference, as "only an interim step toward positive separation of all aircraft at the higher altitudes."

The interim plan, which would apply initially to military aircraft operations and later to commercial jet transports when they enter service in 1958-59, calls for: (1) *Development* of high-altitude charts, using selected navigational aids to give coverage on a grid basis, (2) *Establishment* of high-altitude vectors in conjunction with ARTC's with direct pilot-to-controller communications provided, (3) *Termination* of the existing airways structure at 24,000 feet with minimum altitude separation at 1000 feet between 25,000 and 29,000 feet and 2000 feet above that level. A 20-mile route width is proposed for lateral separation but

time separation would not differ from 10 minutes, and (4) *Continue* use of VFR or 1000 feet on top initially, but eventually considerably reducing this type of operation.

In discussing military research projects which might aid civil air traffic control, Col. Lightner outlined work being done on the altimetry problem, Air Defense Command radars (including SAGE) and Tracals. The latter system is responsible for development, testing and evaluation of military terminal ATC, approach and landing system to handle the traffic of a large number of high-performance planes.

NBAA Member Survey Lists Inadequate Airports

All members of the NBAA were recently urged in the Association's monthly *Airport Letter* to instruct flying personnel to recommend airport improvements now in every community where the landing facilities are inadequate.

The National Airport Plan prepared by CAA and based upon a projection of civil aviation needs up to the year 1960 shows 1,309 General Aviation Airports and 617 Air Commerce Airports to need improvements.

The great majority of the 422 airports on the Federal aid fund allocation list this year are in the Air Commerce Airport category. CAA has pointed out that it is a responsibility of the users of business and private aircraft to urge the public owners of the 1,309 General Aviation Airports to proceed with needed improvements, asking for Federal aid when they need it.

The NBAA *"AIRPORT SURVEY FORM #1"* sent out with a recent *Airport Letter*, has been returned by many NBAA members with plenty of evidence that they know of and are using many inadequate airports, both large and small.

In answer to the question, *"What ten places would be at the top of your list as needing improved landing facilities to accommodate the aircraft of your company?"*, there was a heavy response. Here is a sample of the airports *listed as inadequate:*

Lunkin Airport (Cincinnati), Corpus Christi (Texas), Meigs Field (Chicago), Fond du lac (Wisconsin), Lancaster (Ohio), Bristol (Connecticut), Pontiac (Mich), Danville (Illinois), Bedford (Indiana), Camden (N. J.), East Hampton (N. Y.), Newport (R. I.), Detroit (Mich.), Teterboro (N. J.), Albany (N. Y.), Cleveland Lake Front (Ohio), Cumberland (Maryland), Bellingham (Washington), Milledgeville (Georgia), Clemson (S. C.), Greenville (Tenn.), Ashville (N. C.), Shenandoah (Iowa), Lincoln (Nebr.), and many others.

In answer to the question, *"What would you like to see the Department of Commerce do to assist in providing a system of airports to meet the requirements of the users of aircraft in commerce and industry?"* here are some typical comments:

"Provide all small and medium size towns with all-weather runways."—

"(1) Make known to both local communities and industry that Federal aid is available, (2) survey needs at all incorporated towns, (3) develop an integrated plan."—

"A master plan to supplement large airports in congested areas with business plane airports close in."—

"We need more TVOR's."—

"We need more 3,500 foot paved single strips in small towns."—

"Establish better liaison with city governments to point out growing need for better airports."—

Pre-Flight Planning Reduces Fog Danger

Famous Last Words:—"Can you see the ground yet or should I let down a little more?"

There are three kinds of fog—advection, radiation, and precipitation; however, all have one thing in common, they hide the ground from the unsuspecting pilot.

Many airmen have a habit of neglecting to consider ALL the factors in the weather information available to them. Prior to take-off or while in flight, the pilot receives a report that the ceiling and visibility at his destination only an hour and a half away are both good. On the premise that conditions will remain the same throughout his flight, he continues confidently on his way. Had he observed the small spread between the dew-point and the temperature, the probability of fog could have been predicted and the dangerous situation he found himself in would have been avoided. Specifically: (1) Avoid flying over or toward areas where the temperature and dew-point are close together. Sometimes fog forms rapidly at ground level and extends quickly over large areas. You may not have the time to reach an alternate airport or your destination, (2) Ground fog layers can continue to deepen until an hour or two after sunrise. Avoid planning a night flight where arrival at your destination will be near sunrise, and (3) Airports on hilltops are the last to become foggy; airports in moist valleys tend to fog in early. *Plan your flight accordingly.*

Records Logged In '55 By Business Aviation

Business aircraft deliveries by seven manufacturers totaled 4,434 aircraft retailed at $91,000,000 during 1955, as compared to only 3,071 units retailed at $58,000,000 during 1954—a 44 per cent increase in units and a 57 per cent increase in dollar volume. These figures, released by Joseph T. Geuting, Jr., manager of the Aircraft Industries Association's Utility Airplane Council included 808 twin-engine business planes which accounted for some $50,000,000 of the 1955 volume, as contrasted to only 354 twin-engine unit deliveries for 1954. Aircraft utilization also increased in 1955, Geuting reporting 9,500,000 hours flown by general aviation, a gain of 537,000 hours over 1954. Business flying accounted for 4,300,000 of the hours logged by general aviation. This was 1,000,000 hours more than were flown by all the domestic airlines combined.

Business flying is really booming!

More Airports Needed To Ease Air Transport

Because all air traffic centers on airports, air transportation is more dependent upon fixed terminals than any other mode of transportation.

The usable airspace of the United States is very great. This would seem to open up unlimited possibilities in the expanded use of air space, if air traffic did not converge on so few airports at such a wide range of speeds.

The CAA, charged with responsibility for safe air traffic control, faces a big job in the development and planning for much needed basic changes in the control system. Such changes may have to be radical; may even lead to major changes in some types of aircraft that use the airways. There is so much air space, and so relatively little of it is used, that the approach to a solution for growing congestion may lead to the consideration of entirely new airway use concepts.

One group studying the air traffic control problem believes the area distribution of air traffic merits a closer look. They state that area distribution, with some means on the aircraft for warning against potential collision, would offer increased usability of the air space. They visualize the lower several thousand feet of airspace as uncontrolled, except in the airport approach area. *They point out the need for many more airports and landing strips to offer a wider selection of landing places.* (NBAA Airport Letter.)

MATS Tips Pilots On Freezing Engines

The Military Air Transport Service (MATS) *Flyer* recently offered this sage advice: "When freezing an engine, the question arises as to whether you should tease it to death by intermittently turning its oil off and on or deliver the coup de grace by shutting the oil off and leaving it off. Certain people who make their living by building aircraft engines say that freezing should be continuous. Do it and be done with it.

"Freezing is intended to affect the main and master rod bearings by oil starvation, causing a braking action on the crankshaft. Shutting off the lube causes the bearings to heat up and expand, thereby choking the shaft to a stop. Of course, when you do this, the bearings don't appreciate it and tend to go to pieces. Now, if you fiddle with the oil shut-off valve and give it intermittent first aid with fresh oil, you can wash away a little of your bearings each time. This can progress to a point where you don't have enough bearing to brake the shaft. Now you've done it! You can't stop it and you've created excess play in the shaft. This slack, coupled with the overspeed and vibration, can cause enough wiggle, waggle and wobble to wreck your prop reduction gears. At this point, there is a good chance of your gross weight being reduced by the weight of the prop plus whatever other parts are sliced off as it parts company with your plane.

"If you must freeze your mill, there are several things you may want to do in the interest of life, limb and property. They may help in case 'old whirlaway' decides to leave the premises when things come to a screeching halt out there. Here's a few: Depressurize and move passengers and crew out of the culprit's line of rotation. If you can, turn away from the bad engine while you're freezing it. If the prop snaps

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Round Table

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that the mere intelligence that there is an aircraft in your vicinity on a near collision course doesn't speed up detection time much. If it doesn't speed up your detection time, it isn't going to help you much.

"My thought, on reading the subject we're discussing here today, was that perhaps we needed a good, clear definition of what we mean by a proximity indicator. Do we simply mean an indicator that someone else is in proximity to us, or do we mean some type of a device that will do more?"

Capt. Carl Christenson: "*Well, Bill, that is a good question. I think what we're really talking about is potential collision intelligence. Now understanding that a device must be compatible with the total problem if it is to resolve it, it is felt that we must have a starting point. The basic starting point is the very simple intelligence that another aircraft is in the immediate vicinity. As we grow with and begin understanding this problem we feel that we can then add intelligence to the point that when an aircraft does appear in the immediate vicinity his course will be defined. The information given to the pilot will tell him that there is a possible collision developing and it will also tell him exactly what he has to do about it.*

"*Perhaps other people here have views about this problem. May we hear from you Jean?*"

Jean DuBuque (*National Business Aircraft Association*): "NBAA firmly believes that with the ever increasing use of the airspace by civil and military aircraft, of different speeds and configurations, it is growing more urgent that an accurate and highly reliable 360-degree warning device be developed which will indicate to pilots the proximity of other airplanes, ultimately giving direction, altitude and speed. Because of the dangerously fast closure speeds of some types of planes, the pilot must have advance warning to take corrective action to avoid air collision. Technical experts in the radio and electronics fields have informed us that such a device is possible and within a price range that would not prohibit purchase by pilots and small business plane operators. NBAA heartily endorses any program that would bring this device into being—the sooner the better.

"Within the next decade it is conservatively estimated that there will be approximately 50,000 business airplanes. That number of airplanes, plus the military, plus the airlines, plus the private pilots will indeed saturate the airspace, making it more important than ever that a proximity warning device be available for use at that time."

Capt. Carl Christenson: "*Thank you very much, Jean.*

"*We have here Mr. Armour of AOPA. When we talk about collisions we have to consider the fellow that has his own airplane and likes to go where and when he wants to. He doesn't always care to be restricted like the rest of us to airways. In a great many cases we airline, military and business people, who have the money to develop gadgets and install them on airplanes, don't meet the requirements of the private pilot with these developments. I'm sure, Mr. Armour, that you have some thoughts on our subject. We'd like to hear them.*"

Merrill Armour (*Aircraft Owners & Pilots Association*): "The association is just as interested as anyone else in any device which will help avoid collisions. The problem with respect to any such device is that from the standpoint of cost and weight it must be practical. It's just a matter of economics. So, while we certainly will participate within our limits in the development of any such device, we have to fix these two limitations of cost and weight on it. Within these limitations, you won't find any better customers than the common ordinary pilot."

Capt. Carl Christenson: "*Mr. Armour, that's very encouraging news. Oftentimes we hear that the private pilot isn't too much concerned about this problem, that they feel that there are other ways and means of doing this job. It is good to know that they are concerned, and willing to cooperate and help us out.*"

Merrill Armour: "We do think there are other ways. We think aviation hasn't utilized the brains and the ability available to aid in the solution of this problem. An anti-collision device may be near or far away, but we think steps can and should be taken which will help solve the collision problem now. This is a different problem to me than whether a proximity warning device would be useful and acceptable, and whether we'd like to have it."

Capt. Carl Christenson: "*I think everybody in the industry would agree with your comment that we need some interim measures for the reduction of exposure to air collision. From what I know of the activities going on within the entire industry, steps are being taken by every segment. Perhaps Craig Timmerman from ATA has some things to say about both the proximity indicator problem and interim measures.*"

Craig F. Timmerman (*Air Transport Association of America*): "We in the Air Transport Association working on behalf of the scheduled airlines, have long recognized, in conjunction with the chief pilots of the airlines who are the people primarily responsible for the safety of flight, that the collision problem is one of considerable severity. "Within our organization we have created what we call a VFR committee. Perhaps this is rather an odd name for a committee but it is significant of the fact that we are concerned with the collision problem under VFR weather conditions as well as under instrument conditions. We have always felt reasonably secure in the fact that we have a traffic control system that, while inadequate in scope, has done very well as a safety device in taking care of the instrument flying situation. But, as has been mentioned by previous speakers, the safety provision of VFR flying, the see-and-be-seen concept, is no longer valid in many circumstances. I wish to emphasize that we certainly don't think it invalid in all cases, but it is invalid in many circumstances, and particularly in the high closure rates of today. In extreme cases, these rates can be almost up to 2,000 miles an hour. Under these conditions, provision must be made to augment the pilot's ability to observe other aircraft in his flight path and take evasive action. One of the conclusions that the VFR committee came to was that we had to get a proximity warning indicator of some kind as soon as possible. It was agreed that the device must do more than warn of the presence of aircraft; it must give other intelligence and, in fact, we even hoped that it might indicate appropriate evasive action. This same committee has worked on many other phases of improving the situation under VFR conditions from a separation standpoint.

"I think I should point out that with the developing congestion in the airspace, the collision warning device would, in my mind, have two applications: 1) Its primary application would be in those areas where we do not have traffic control protection or under those weather conditions where we do not have traffic control protection, and 2) It would augment the traffic control system which, as the volume and the speeds increase, will become more and more difficult for the traffic control people to cope with. The proximity warning indicator would make up for such things as human error by either pilots or traffic controllers.

"Speaking for the airline representation on the VFR committee, we feel that the development of this device is not only desirable but is mandatory if our technical people can come up with a satisfactory solution. We feel confident they can and, of course, are doing everything possible to encourage them."

Capt. Carl Christenson: "*Thank you very much, Craig. I might also add that as a result of this early work on the problem we have a committee in RTCA, previously mentioned by Colonel Sisler, entitled SC-74 which has the responsibility for establishing the operating requirements of such a device. Now, it is perhaps a bit presumptuous in view of this preliminary work that I should be sitting here sharing a discussion as to whether or not such a device is needed. I think that the expression of opinion and thought here indicates that the industry is well in accord with the answer that it is very definitely needed and that its development is almost mandatory. And further, in consideration of the operating problems of the non-airlines pilot and the many phases of military operation, that this device should also be compatible with the economics of the other segments of the aviation business.*

"*Now that we've progressed that far, and I believe emphatically answered the question as to whether it is needed or not, we have here with us Mr. George Church of Bendix who I'm sure can tell us about the technical side of the problem.*"

George Church (*Bendix Radio Division*): "We've really talked about two different types of machines, a proximity warning device and an aid to collision prevention. They really serve two slightly different purposes. If you consider a collision, the hazard originally starts off completely unknown. A proximity warning will alert the pilot in case he had not already been paying 100 per cent attention. This is about all you get from the basic proximity warning device. The amount of time that's required from there on to figure out where

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FUELS-OILS

Features and Facts Pertinent to Successful Flight Operations

Knock, Octane, and Power Called Top Fuel Confusion

What is it about aviation fuel that seems to be least understood by the greatest number of pilots in the business-utility fleet? When SKYWAYS put that question recently to R. C. (Bob) Wormald, assistant manager of Esso Standard Oil's Aviation Department, the answer came back without any hesitation: "Knock ratings and their relationship to power."

In the first place, octane number does *not* indicate the power in fuel. It indicates *only* the relative ability of that fuel to resist knocking.

Knocking, of course, occurs when fuel burns in an uncontrolled fashion, releasing its energy too fast for the pistons to take advantage of it and resulting in an explosive "knock" rather than in a smooth push against the pistons.

In conditions of that sort, when throttle settings are unchanged, the abnormal heat generated by a knocking fuel continues to build up until either the piston is burned through or the head is blown off.

Therein lies one of the first common misconceptions. High octane fuels, or fuels, in other words, that can resist knocking best, are often thought to be "too hot" for some engines. On the contrary, the fuel resists knocking, the *cooler* it burns.

In designing power plants, however, the higher the octane number of the fuel the engine designer intends to use, the higher the compression ratio he can design in that engine, or the greater the amount of supercharging he can incorporate, thereby obtaining higher horsepower output.

Now, how are the knocking qualities of fuels rated? Knowing this is a necessary preamble to getting the octane knock, performance, power picture clearly in focus.

Aircraft engines, of course, are designed for two critical conditions—lean mixture cruising, with fuel economy in mind, and rich-mixture take-off and climb where full power is the goal. In both cases a high anti-knock quality is needed. To obtain it, two distinct knock rating tests have been devised for av-gas.

One is the American Society for Testing Materials Aviation Method which involves a lean mixture. In this test method, the fuel being observed is compared with a mixture of iso-octane, which has a defined octane number of 100, and heptane which has a rating of zero and will knock in just about any engine that can be built.

For ratings up to 100, the percentage of iso-octane needed to produce a knocking that is equivalent to the fuel being tested determines the octane number; e.g. 80 percent iso-octane means "80 octane" fuel.

The other test method is called the CFR Supercharge Rich Method and uses a supercharged test engine from which ratings are taken based upon performance that represents the rich-mixture condition permitting maximum knock-limited power.

Above ratings of 100 octane, in both of these methods, the ratings are technically reported as the number of milliliters of tetraethyl lead necessary to add to the iso-octane to cause it to equal the test fuel in anti-knock value.

But, to simplify these ratings of above 100, *Performance Number* ratings have been set. These numbers started with the supercharge method of testing as more and more anti-knock quality was demanded of av-gas.

The numbers are based upon the percentage of knock-free power that can be developed in the average of various aircraft engines with different amounts of TEL in iso-octane as compared to iso without lead. Iso-octane with 1.28 milliliters of lead gave about 30% more power under supercharged rich conditions, or 130% of power possible with unleaded fuel, and was given the Performance Number of 130. Other ratings were obtained and, now, it is possible to convert knock ratings in terms of either iso-octane plus lead or of octane number into equivalent Performance Numbers. Tables and formula for the different ratings accompany this story.

Av-gases currently are designated for convenience by two descriptive numbers. The first represents the nominal rating by the lean-mixture ASTM Aviation Method. The second number represents the rating by the Supercharge Rich Method. *Numbers up to 100 refer to octane numbers. Numbers above 100 refer to Performance Numbers,* thus the importance of the conversion formulas and charts.

Using fuels of a higher grade than spe-

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Round Table

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the other aircraft is, what the hazard is and what to do about it and then for the required evasive action, is not reduced by the warning.

"Now, the design of a proximity warner is fairly easy compared to a collision avoidance device. You can solve them as separate problems if you chose or you can start out by solving the first problem because it is easier. But you have then only cut out the time required to get people aware that there is a hazard. We, as manufacturers, naturally are interested in building devices like these and so we started an investigation to find out how accurate a system would have to be to achieve the purposes that we are setting forth here. We are in the middle of such a study now and I don't have final data. Dr. J. S. Morrell, a well known mathematician, is going through the physical analysis of the problem of collision. He is doing some rather extensive work and it will perhaps be a couple of months yet before the work is completed.

"However, among the things that his mathematics show is that there is a real problem in phase two. I have a series of preliminary graphs in front of me which I dragged from his notebook before I left home. They indicate that in the usual case you cannot avoid another aircraft if you don't have an average of 15 to 20 seconds from the start of the aircraft's evasive action. We only can estimate the time it takes the pilot to react and the time it takes for the aircraft to react. But from there on it's a matter of straight mathematics. In that area we did go into it rather thoroughly. After you get to the point where the airplane is banked and begins to turn, you then have something on the order of 20 seconds before your aircraft will be about 1,000 feet away from the point of hazard.

"Now, if you could define a point of hazard so specifically in your equipment that it were just the dimension of the aircraft, you wouldn't have to get 1,000 feet away, you'd only have to get a dimension of an aircraft away. If your system is not accurate enough to measure this hazard by the dimension of the aircraft, you then have to figure out how accurate your measurement is and you have to avoid by that much; maybe 1,000 feet, maybe a mile, or maybe more. If it is a mile, you obviously must start your turn much earlier to get away from the hazard point.

"To summarize, you need your alert time, you need your pilot decision time and the pilot and aircraft reaction time. From then on you need what appears to be 20 seconds in the usual case. Unfortunately, this 20 seconds is not an absolute case because we have discovered that there are cases where, at the end of 30 seconds, whether you continue to fly straight ahead, whether you make a left turn or whether you make a right turn, you have accomplished nothing. You're in just as dangerous a position when you are done as when you started. It so happens that this hazard is roughly in the area of about 90 degrees to your left or right. If you make a turn to the left or to the right, it doesn't help you. You get a few 100 feet left or right or where you would have been otherwise, but since you didn't know by a few hundred feet whether you were going to hit or not, you may have done little good. Good collision warning is a difficult problem. You have to measure information well in advance and quite accurately to genuinely avoid collision. You also need to know where the hazard is coming from, left or right for example, although our analysis is based on either vertical or lateral maneuvers.

"Actually, you must know the hazard angle fairly accurately for minimum avoidance time, since as little as a 10° difference might dictate the opposite maneuver in a a few critical cases. If we had adequate decision data about 60 seconds ahead, a turn in either direction would be adequate —except for the possible creation of a new hazard with a third aircraft. Unfortunately, an independent system capable of such long range accuracy appears to be impractically difficult.

"It seems at the moment to be a much easier problem to solve if we use a cooperative system. That is, get some of the basic information from the other craft rather than try to measure it absolutely. A couple of numbers here might be of some interest. If we want to determine whether an aircraft is going to miss us by 500 feet —in other words, if we decide that we want to protect a 500 foot area around us and want to know whether an aircraft is going to come within that area—and we want to know this information 30 seconds ahead of time, then we need the following measurement accuracies, varying with the closing rate. I have a couple of sets of figures here, for a closing rate of 200 feet per second, 500 feet per second and 1,000 feet per second—two hundred feet per second is about 120 knots.

"Let me backtract a moment for clarity. An independent system can detect an impending collision by one of two means, angle measurement or range measurement. If the relative angle to the other aircraft is constant, a collision will occur. Or, if the closing speed—second derivative of range —is constant, a collision will occur. The only exceptions to this, and both are fail-safe, are aircraft flying parallel courses, and aircraft leaving a point of previous theoretical collision. These are the two basic parameters capable of measurement in a non-cooperative, independent system. We have tried to figure out how accurately it was necessary to measure thes two parameters.

"Going back to the date I started to give, if the closure rate is 120 knots, then, in the case of the angular measurement, you need to be able to measure the change in angle to an accuracy of .15 degrees per second. To take the other extreme of my figures, if the equivalent closing rate of the two aircraft is 600 knots, the accuracy of the angular measurement must be in the order of .07 degrees per second change in angle. And if you want to make the measurement in terms of change in closing speed for those same speeds, you would have to measure .15 foot per second per second for a 120 knot aircraft, and for a 600 knot aircraft it's roughly .10 foot per second per second. If you had to measure the data only 10 seconds in advance, however, there is a big difference in required accuracy, since

(*Continued on page* 38)

SQUAWK SHEET

'Jitters' In Autopilots-Airborne Radar

Pilots and maintenance personnel who have been experiencing difficulty with both autopilot and radar image "jitters" will be interested in a recent report by Henry Oman of Boeing at a meeting of the American Institute of Electrical Engineers at Dallas, Texas. During an aircraft power generation session, he pointed out that variation of frequency, particularly if cyclic, can adversely effect the performance of sensitive equipment such as autopilots, airborne radar and navigation computers.

Variations in frequency about a nominal value can be cyclic or random. Generally, motors are not seriously affected by small variations in frequency and lamps and heaters are unaffected.

However, an autopilot may be designed to have response rates of about 6 cps in order to move the control surfaces fast enough to limit airplane altitude and atitude deviations. Small changes in airplane electric power frequency occurring at a cyclic rate in the order of 6 cps can cause annoying "buzz" or "jitters" in the pilot's rudder pedals. Larger amounts of frequency modulation *can cause movements* in the airplane control surfaces.

Radar-type equipment also seems sensitive to frequency modulation. One common effect is unstable or *fuzzy images on cathode-ray tubes* (scopes). Non-cyclic or occasional frequency dips and rises resulting from load changes in the airplane's electrical system are expected, and apparently have no serious or persisting effect on the electronic equipment.

New Aluminum Surface Conversion Coating

Development of a process that provides aluminum with a surface conversion coating for protection against corrosion, for improvement of paint adhesion and for ornamentation has been announced by Turco Products, Inc., Los Angeles. Called Turcoat 4178 the chief advantage of the new process is the "quick fix" offered by the Turcoat material. The coating becomes *fixed and non-smearing immediately upon application,* whereas most other coatings will smear or streak if parts processed are handled or moved while still wet. Parts coated with Turcoat 4178 can be freely handled and racked while still wet. Drying is unnecessary, bottlenecks in production lines are eliminated.

The coating formed by the Turcoat 4178 process is of the surface conversion type. That is, the coating is actually partially derived from the metal surface itself and is, therefore, firmly interlocked and integral with the metal surface and extends into every crevice. It is acid resistant and offers only a very low electrical resistance. It is not brittle. The metal can be bent or formed after the coating is applied. Applied by immersion, spray washer or by conventional hand methods, the coating formed by the new process is a thin, smooth, non-crystalline film with a slight metallic lustre. The color is a light golden yellow, with red and greenish irridescence.

The Turcoat 4178 process is easy to control, pH being the only critical point. Although standard temperatures and concentrations are observed, these features are not critical, and minor deviations made by the consumer-user will not throw the process out of kilter.

Furnished in dry powdered form, Turcoat 4178 is free from objectionable odors and dangerous fuming. It is not hazardous to handle. It is shipped in ordinary containers and is non-caking and convenient to use when received.

Preformed Aircraft Hose Assemblies

Factory-preformed Teflon aircraft hose assemblies that save weight and space and eliminate the need for special elbows, can now be obtained from Resistoflex Corporation, Roseland, N. J., manufacturers of engineered flexible hose assemblies and plastic materials for industrial and aircraft applications.

Known as Preformed Fluoroflex-T R3800 hose assemblies, the lines are permanently formed to clear obstructions and make connection in the shortest possible length. Preforming permits substantially smaller bend radii with minimum restriction of inside diameter when compared to unpreformed assemblies, it is claimed. By permanently preforming the hose during manufacture, stress and strain is eliminated in the critical bends and neat, efficient plumbing design is made easy, according to the Resistoflex company reports.

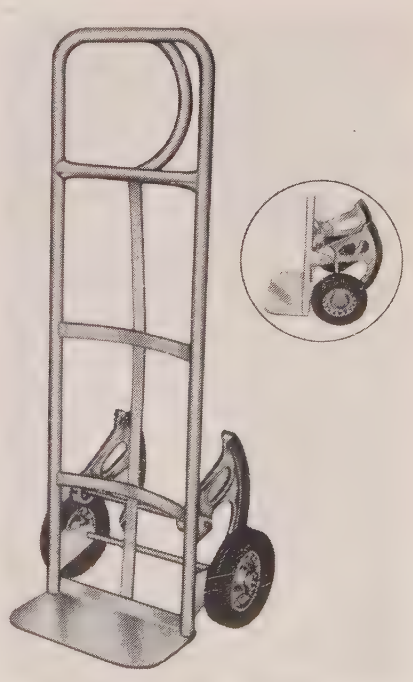
Fluoroflex-T hose has a minus 100 to plus 500 degree F ambient temperature range, 1000 psi working pressure and complete inertness to all known oils, fuels and propellants. It has been in flight service for over three years in fighters, bombers, missiles, helicopters and commercial transports, Resistoflex field engineers report. Fluoroflex-T hose has been approved by the Armed Services and CAA.

Labor-Saving Stair Climbing Hand Truck

Precision Equipment Co. announces production of an amazing new stair climbing hand truck which has been designed to fill the needs of countless companies who have found it necessary to drag loads over curbs and up and down stairways to and from hangar lofts and other places having stairs.

This remarkable hand truck has no equal in multi-level trucking operations! Moving stock to upstairs storage rooms need no longer be a backbreaking, hazardous chore! *E-Z Climber's* two rocker-arms act like an extra pair of wheels, keeping the truck on a constant line for *friction-free travel.* Its size and superb maneuverability make it ideally suited even when there are doorway and aisle limitations. The *E-Z Climber* is strongly built with a heavy 1" O.D. tubular steel frame—*electrically welded* for utmost rigidity—with curved cross members. The 9" x 14" W nose-plate is of heavy 3/16" steel. The unit has a *reinforced base plate beam.* The semi-pneumatic, 10" x 2.75", steel disc wheels are ideal even on rough surfaces. Load capacity is 600 lbs. Overall size 46" H x 18¾" W. It comes in attractive red finish and the shipping weight is 30 lbs.

Although the regular price of this amazing new truck is $44.90, as a special introductory offer to readers of this magazine, Precision Equipment Co. will fill orders at $34.90 F.O.B. Illinois. You must mention the name of this magazine, however, to obtain the truck at this special price. Ask for literature or send your order to Precision Equipment Co., 3716 N. Milwaukee Ave., Chicago 41, Ill.



Round Table

(*Continued from page 36*)

this is not a linear relationship. So, if you could avoid another aircraft with 10 seconds warning, the problem would be very nicely solved by much less accuracy in the equipment.

"These rates, of course, are quite difficult; in particular the range rate. Now, we are only in the middle of our study, but these figures show the difficulty of the problem if you operate a non-cooperative, independent system. The same areas of accuracy do not appear to be required for a cooperative system."

Jerry Lederer: "I'd like to congratulate Bendix. It's the first time I've heard the numbers."

George Church: "The numbers are not completed yet. When they are completed, we propose making this paper available to the industry for whatever help it may provide toward the eventual solution to the problem."

Capt. Carl Christenson: *"Thank you very much, George. I think the most significant thing, as Jerry has pointed out, is the fact that people are studying the problem. There are a number of other studies dating back many years, but we're just now getting facts and figures that are beginning to define the areas of the problem and are beginning to point to the types of equipment that we can hope to develop. I, too, would like to congratulate Bendix and also congratulate the other manufacturers who are in the midst of similar studies. I think we should congratulate as well all of the people who are pooling their general knowledge and the results of their studies in the hopes that we can solve this problem. I'd like at this time to open up the discussion to some around the table questions."*

Jean DuBuque: "After hearing NBAA member Bendix give such an excellent analysis of the problem, I'd like to ask several questions. First, George, you indicated that the problem of incorporating all aspects of proximity warning in one device would prove difficult. Could you give us any idea of just what size black box might be involved and any inkling as to what the approximate cost might be for one incorporating altitude, distance and speed as a means of indication?"

George Church: "I don't quite understand the question."

Jean DuBuque: "In other words, could you incorporate altitude, speed and distance in a visual form in a black box that would give the pilot an intelligent analysis of the approaching aircraft?"

George Church: "Are you asking about a box which would transmit this information to someone else for their use or gather this information independently?"

Jean DuBuque: "Gather it independently."

George Church: "If you gather it independently, you have to gather speed. The only speed information you can gather is closing rate. You cannot gather the other aircraft's speed independently. You can only gather it in terms of closing rate and change in angle; it is the only measurement you can make from another point, but these are pertinent figures.

"Gathering another aircraft's altitude, to anywhere near the accuracy that the other aircraft already knows it, would be quite difficult. On ground equipment you can gather this with a radar height-finder. The accuracy of such height-finders, within the range that you're talking about here, is just about equivalent to what you can do with the altimeter in the aircraft. These ground height-finders, because of the narrow beam width—usually a fraction of a degree of actual beam width in scan—are extremely expensive. I couldn't make an estimate of how to get this accuracy in a similar manner in an aircraft. I don't mean you can't get it in an aircraft, but you can't get it in the same manner because of the physical size of the components involved.

"It's difficult to talk price on a piece of equipment requiring such accuracy. You cannot, for example, estimate how expensive it is to build a piece of equipment which will detect an aircraft's speed change of a fraction of a foot per second per second when you know that random fluctuations of the aircraft closing rate will be greater then this. If you're reading from his tail, his tail will move back and forth a few feet, and he has changed his rates by considerably more than the thing you measure. While if you're measuring an angle, unless you can hold the heading of your aircraft to the angular accuracy of a small fraction of a degree while you're making the measurement, the information is misleading by this factor. You see, you can actually mislead yourself into thinking that you're about to collide with an aircraft when you are not; you can also mislead yourself into thinking you're not, when you are. If you're in a very gradual turn—five per cent of standard rate, for instance—you will then convince yourself that you're in a safe zone, while on a collision course, because the system isn't smart enough to know who is causing the change of angle."

Capt. Carl Christenson: *"However, as you get closer and closer and closer these errors begin to disappear."*

George Church: "That's right."

Capt. Carl Christenson: *"Because you're measuring greater speed differentials and greater angle of change. Is this correct?"*

George Church: "It is very, very definitely correct, drastically correct if you'll look at the curves. The numbers I was reading were down in the bottom area of this curve. As time goes toward zero you go completely off the top of this graph. We intend to make these graphs available with our final report."

Jean DuBuque: "Assuming that your airplane is equipped with a scanning device that reached out on a 360-degree radius, for say some 30 to 50 miles, and alerted you when an aircraft crossed the outer limits of the device, would that provide adequate warning to avoid collision?"

George Church: "It would not be difficult to say ring a bell or flash this particular target on and off, or whatever you chose to do to call attention to that aircraft. Sixty miles is difficult on an airborne radar set because it constitutes fairly high power with a small aircraft as a target. You can get this information, but in order to know whether that aircraft is going to collide with you or not you have to read what he is doing quite accurately in one of the two parameters I've mentioned. The first impression you get on any piece of equipment measuring the angle change or the closure rate change is that the aircraft is going to collide with you because at great distances you will get very small angular variations and very small changes in closing rates with time. Both of these indicate collision, so that the first data you get at long range is that you are going to collide with everybody in the sky. You have to sweat it out and wait until some minimum time in order to get more accurate data before you can decide whether this is true or not."

Jean DuBuque: "Could you give us an estimate of that minimum time and distance?"

George Church: "Well, the minimum time we're talking about is 20 seconds, 20 seconds to turn your aircraft out of the way of the collision if you want to miss by roughly 1,000 feet, if your system is accurate to 1,000 feet. You have to add to this 20 seconds the time it took you to gather the data, the time it took you to decide what to do about this data and the time it takes the aircraft physically to begin to turn. The distances involved will vary with aircraft speed and heading from near zero to around 20 miles for two head-on jets."

Jerry Lederer: "You're still talking about the non-cooperative system, though, aren't you?"

George Church: "No, in that last question it doesn't matter what kind of system —an aircraft takes just as long to move after you know what you're going to do."

Jerry Lederer: "I mean your previous remarks about the difficulty of getting . . ."

George Church: "Yes. My previous remarks about the difficulty of a system deals with a non-cooperative system. We went into that first because it's the most inviting. You'd much rather have an independent system, it requires no coordination. If you've got it, you have protection, if you don't have it you don't have protection. It's a nice clean system to design, so naturally we studied it first. We are, in the same paper, studying the accuracy requirements for a cooperative system, assuming that we can pass data back and forth. This study's not complete enough now to give the data but the reaction so far is that the accuracies required are much less.

"Now another thing you can do to make such a system work is to get your aircraft closer by reducing the closure rates. If you can control your traffic in such a way then you never have very high closure rate, then the accuracy of equipment required to solve your problem is very drastically reduced. It may be that we will have to compromise between a lot of things like controlling the traffic, putting them in speed zones, and what have you, so that we can get good data and read it accurately enough with the equipment."

Capt. Carl Christenson: *"I'm afraid that the tendency in speed and the desire to fly anywhere you want to fly is going to necessarily limit the possibilities along that line. Certainly, when a Texas millionaire gets his first jet private airplane he is going to be at 30,000 feet too. He probably won't*

want to confine himself to the airways. So I think we have to look to good sound basic solutions to the problems without depending on traffic regulation in order to make this gadget work."

George Church: "I did not mean to advocate control. I'm only trying to present the physical limitations of the situation from our mathematical study. It is our part, let's say, to try to give the information which will help us all to solve the problem. If we can give this data, then after everybody examines it they may draw various conclusions as to what is a good solution to the problem. Dr. Morrell's paper does not solve the problem, it only presents the aspects of the problem with which we felt we could cope with the talent we have in our establishment."

Jerry Lederer: "I suppose the solution to the proximity indicator will also solve the problem of flying into obstructions on the ground, that is, television towers, high buildings and so forth."

George Church: "So far as our study to date is concerned, it's not talking about equipment, though depending on how you solve the problem this may or may not be so. It strikes me that depending on how you solve the problem you may solve a lot of other problems in the same equipment.

"There is one thing that I do want to say that I haven't said before. That is that there is no telling how many near misses would have been collisions had the pilot done nothing. He may have accomplished nothing in attempting to avoid. We may go a long way on a false start before we get enough good statistics to prove that we're on the wrong track. We must be somewhat cautious in going ahead with this equipment to make sure that we are on sound footing. You can't build up history very rapidly in this connection."

Capt. Carl Christenson: *"Well, I agree that statistically perhaps we don't know that answer. However, statistically again, as Jerry Lederer pointed out, there have been 123 collisions since 1948 and over 50 of them have been fatal. To lend further emphasis to that fact, many of the near misses reported previously in other studies have required rather violent action on the part of the crew. I agree with that action because otherwise we wouldn't be concerned about statistics now. The importance of that lies in the fact that statistically it may be 100 years before we have the kind of accidents which will force everybody into the development of this device. On the other hand it may happen tomorrow. From the standpoint of pure safety engineering, which is based primarily on elimination of the exposure of the danger, it is very important that we not wait statistically to find out whether or not we need this thing. I think that in this problem we are morally obligated to find a solution to it before it becomes statistically necessary."*

George Church: "I was not advocating waiting. I was only advocating that we try to be on as firm ground as possible. We should seriously think about what we're building before we build it because it may take us a couple of years after we've got it built and operating to discover whether we made a mistake."

Capt. Carl Christenson: *"This is very true."*

Merrill Armour: "Are there any predictions as to when a thing like this would be built, how much it will cost, how much it will weigh to start with?"

George Church: "I am at a loss to make such a prediction. I think that we will soon know—I think that there's so much activity going on that we're bound to resolve this very rapidly. I really don't know whether we're talking about resolving it as a compatible, as an independent or as a joint system so far either."

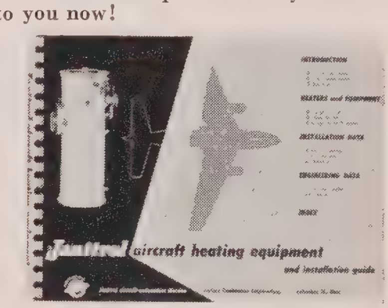
Capt. Carl Christenson: *"All of the thinking on this problem and specifically the studies by the VFR committee and the SC-74 committee, have tried consistently to develop compatible systems that would be within the price range and within the ability of each segment of the aviation industry. We feel that this is necessary in order to arrive at a fundamental solution. It may be that the initial system may be the type that will be purchased by NBAA, the airlines and military but, at the same time, there may be warning devices, very simple position or proximity indicators, entirely compatible with the larger system, that could be supplied to the private operator."*

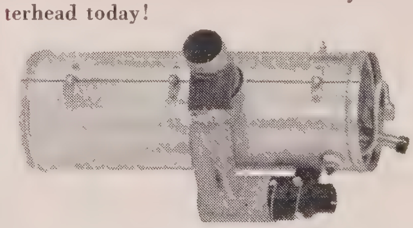
Merrill Armour: "Well, I'm certainly glad to hear that. Being a lawyer instead of an engineer I can speak glibly about such things. From what I hear it seems that we're not going to develop this device for general aviation within the next year or two. However, it does seem, from what I gather, that there is a possibility of developing a device for high-speed, large aircraft use. Statistics indicate that they've created the greatest problem so it's logical that we should start out there. I think it would be a great help to the industry if we could somehow get this started there and then move on."

Capt. Carl Christenson: *"Well, Merrill, I would like to comment on your observation that large, high-speed aircraft are the greatest problem. We're very much interested in the fact that the greatest majority of collision accidents are occurring in the non-air carrier category. Because of the fundamental interest we all have in this problem, we think we have to solve that problem for the benefit of aviation. We hope that by working on a compatible solution we will be successful."*

Merrill Armour: "You are correct that the greatest majority of collision accidents are occurring in the non-air carrier category. However, when you consider the number of aircraft in the non-air carrier category as compared with the air carrier category, you would expect that there would be a great many more collisions in the non-air carrier category. I do not remember the statistics put out by CAA but I do recall reading them. It is my recollection that there are 30 and maybe 50 times more non-air carrier aircraft than there are air carrier. To do a thorough analysis would require the use of figures as to hours flown as well as the number of planes and the number of pilots in the planes, and all the various factors that the safety analyst uses. I do not recall having ever seen such an analysis anytime, but I do believe that if it were made we might find that the collision record insofar as the responsibility for collisions are concerned would

(Continued on page 40)





Round Table

(*Continued from page 39*)

be pretty good for the light plane operators. However, one thing we all know with certainty, and that is that speed is one of the factors which increases tremendously the collision hazard."

William Barnes: "I just wanted to say one thing. I think this type of discussion is healthy. We of CAA have been concerned necessarily about mid-air collisions for some time. We have several projects, one of them that was initiated last June, which would develop specifications for a proximity warning device. Now I didn't state that earlier because it looked as if we had pre-judged the question also, but I think that more than one approach to the problem is desirable at this stage.

"I judge the Bendix approach is a radar approach. The optical people at Indianapolis last fall stated specifically that they could provide an optical system that would provide automatic indication. They said it was only a question of cost. Now in view of the fact that the statistics available show a high percentage of collisions and near collisions occurring in daylight with practically unrestricted visibility, I'd like to see the military or somebody work with these optical people on what may be an interesting solution. We don't want to wait for the ultimate. I think it's desirable to pursue as many promising courses as possible."

Capt. Carl Christenson: *"I might point out that two or three years ago, United Air Lines, working with the Douglas Aircraft Company and the Pacific Optical Company, attempted to find a solution to this problem without becoming involved in computer boxes and so forth. We installed in a DC-3 at Denver a number of such systems including 180-degree lenses, periscopes and rear view mirrors. What we learned was simply this, that without an automatic computer device it required you to spend all your time looking in this gadget if you wished to see what you would otherwise see except for certain areas to the rear of the airplane. As a result of that early work, and the detail with which we attempted to develop such a device, we came to the conclusion that we were barking up the wrong tree. You see only that which you would otherwise see outside of the windshield."*

William Barnes: "I don't know what these devices are. I understand they are classified. The study I referred to earlier concluded that the ratio of sighting distance to detection distance was three to one. In other words, if you were looking in the right place at the right time, it's possible to see an aircraft three times further than the average detection distance. Now as to these optical devices, Eastman and Farrand Optical stated without reservation that they had devices that would provide automatic proximity indication to the limit of visual range. This could increase detection distance by a factor of three."

Capt. Carl Christenson: *"Well, anything that deals with optics also has to deal with restriction in visibility. It is true that such a solution may lend itself to the CAVU condition, but it certainly does not lend itself to the restricted visibility condition. This is important on the Eastern seaboard. It's important out on the West Coast. It's important wherever you fly, except perhaps in Arizona, and New Mexico and Colorado where, thank God, we normally have visibilities of 125 miles."*

Jerry Lederer: "Regarding this matter of using an optical system under reduced visibility conditions, has Bendix given any thought to the use of infra-red for what you might call a cooperative system?"

George Church: "Bendix is starting its program by trying to figure out what kind of system and what kind of measurements we need to make. We want to know how accurately we need to measure the parameters, and then, after that, try to figure out what kind of system is the best way to do the job. We do not propose radar, we do not propose anything so far.

"There is one point I want to make that I didn't make before in my figures. We had assumed moderate evasive action in my data, or a half-G turn. In effect, this is equivalent to a 27-degree bank. We also in our arithmetic have done this for a one-G turn, which is about a 45-degree bank. I'd like to ask whether we are using the right numbers, whether we should also consider G's beyond this, whether an aircraft would turn more than a 45-degree bank effectively. Our calculations use the term G so that we can talk climb, descent, slow-up, speed-up or turn, and keep our arithmetic general. But to convert it to horizontal and talk about bank gives us a number that we can all recognize."

Jerry Lederer: "From the point of view of passenger comfort, half a G is about as far as you can go."

Merrill Armour: "From the point of view of saving your life, I'd go a lot further than that. We certainly wouldn't want to put any limits like that on it.

"It seems to me that we have developed two problems, or two phases of the problem. One is limited visibility and the other is clear visibility. Statistically, we've established that people run into each most often when they can see. For general aviation that makes it our most serious problem. Ultimately it will not be. I'm sure ultimately we'll fly in limited visibility, but at the present we've got to try to see each other when there is plenty of visibility. Any device which will aid that at this time is, in my opinion, very worthwhile. We shouldn't be skipping over that one at all; we should be putting everything into it if it is more feasible and more likely to be developed first."

Capt. Carl Christenson: *"I think we agree with your thinking."*

Jean DuBuque: "I understand that one photographic organization has developed a device that will penetrate haze and poor visibility up to a distance of 25 miles or more and take a clear and distinct photograph. Now, I am wondering whether such a principle could be utilized in connection with proximity warning. I heard that the Air Force not long ago had an unusual and hazardous experience during poor visibility when one flight of bombers passed through another flight of bombers without seeing each other. Strange as it may seem, it actually happened. Maybe a device that penetrates haze and warns simultaneously would be helpful to everyone."

William Barnes: "I would like to ask a question. Due to the dimensions of the air-

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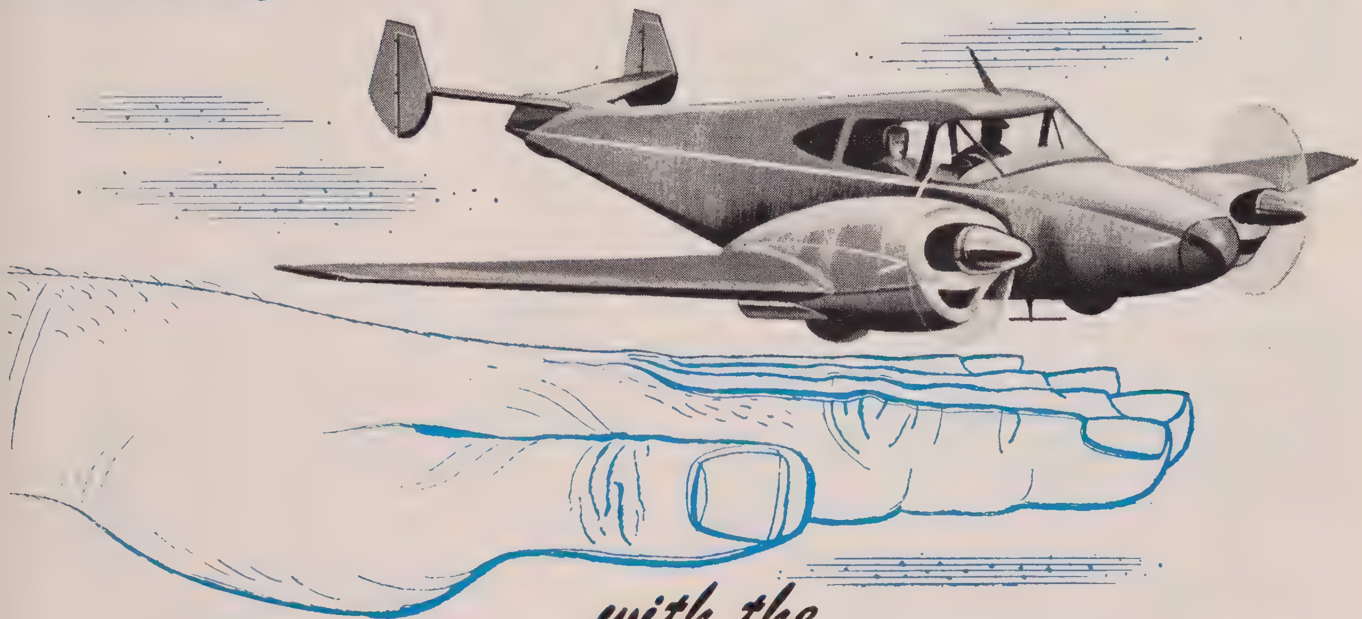

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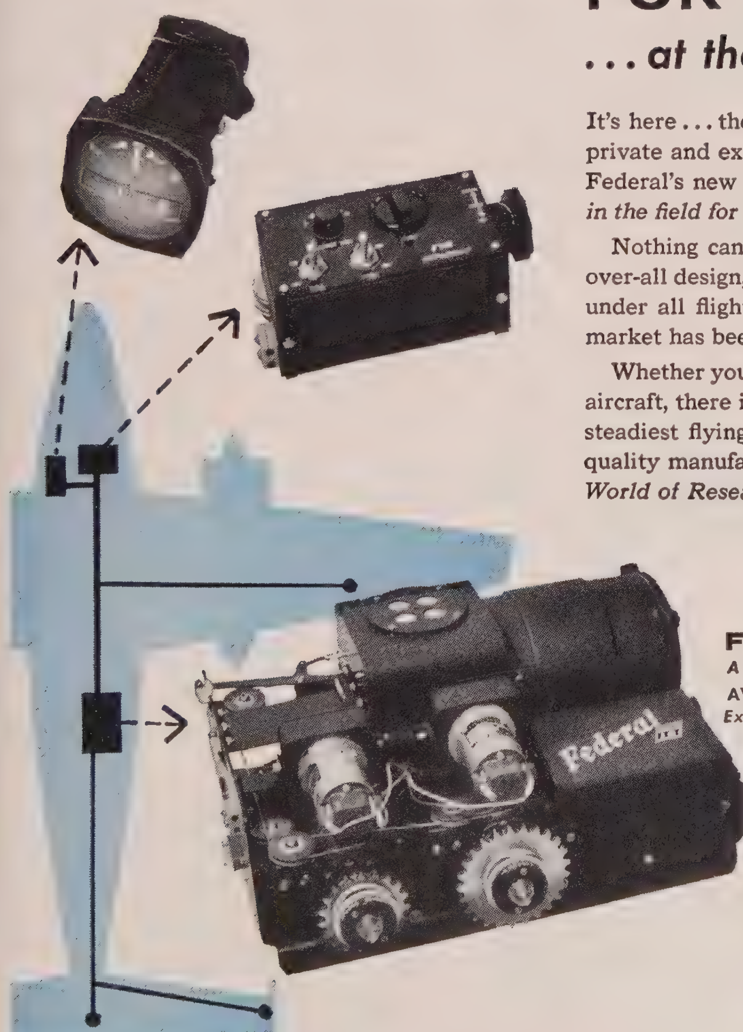

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craft, the quickest way to miss another aircraft is not to turn, it's to go up or down because they're wide but they're not very tall. Why don't we talk about vertical deviation sometime? I think that's the quickest way to miss a collision."

Jerry Lederer: "The quickest way is to go down. That way you have G working with you. You go up, G is against you."

George Church: "I talk turning merely to get to a terminology to convert all these G's we've talked about into a common language, so that I could say what the required bank was equivalent to in G's. Our study, so far, is not talking about turning; it's talking about climbing or descending or turning left or right or slowing up or speeding up because these all place acceleration on your aircraft in one plane or another. It is not necessarily true that you can make changes more rapidly in elevation. There may be less inertia trying to get your aircraft into the start of a climb than you have starting a turn because you've got some big, long wings that you have to swing around in the start of a turn, but you cannot maintain a half G climb, you don't have that much horsepower, and you can't maintain a half G descent because you will build up terrific speeds very shortly. However, you can make small variations in elevation and maybe you can start them more rapidly. If you use a cooperative system you have better position information in elevation than in any other plane. You have altimeters in aircraft which are quite accurate in terms of a few 100 feet. You have no such position informatiin in any other plane. Therefore, the elevation situation is quite inviting, especially in a cooperative system because you don't have to allow a 1,000 foot miss distance in elevation. You have an accurate system which will allow you to talk in smaller dimensions."

Capt. Carl Christenson: *"May we then summarize in answer to the question we are here today to discuss that our understanding is that we are talking about intelligence which will allow us to avoid collisions. The progress which has been made upon this problem as of this time through the interest and energy of the entire industry, appears to be very promising. It is very important for all of us to realize that this interest has been devoted to the entire aircraft industry and is not isolated to any one particular segment of it. I think that we should take this opportunity to both congratulate and thank the many individuals and organizations throughout the industry who have contributed to the eventual development of this device. It is fortunate that for once in our lifetime we have the private pilot, the business pilot, the airline pilot, and their various representative organizations teaming up with the military, the Navy, and now the Army. All are very cognizant of the fact that air collision is probably the most serious of all the types of accidents that we have because gravity is always there. We can be assured that this interest will continue until this problem is solved.*

"I would like to thank each and every one of you here for your contributions and SKYWAYS Magazine for the opportunity of being here."

Company's Costs

(*Continued from page* 11)

During the two year period which is covered by the material made available to SKYWAYS for this presentation, The Company maintained a very stable fleet. The only planes purchased during that period were three of the Cessna 140's. One of those, however, was a replacement for a similar aircraft destroyed in a hangar fire.

The Company's capital expenditure for the additions to the fleet were approximately $9,000.

As mentioned before, the basic maintenance and even refitting of the planes was done by The Company's own shop personnel. The exceptions to the "at home" work rule are the larger engines of the *Lodestars*, PV-1, and DC-3.

The Company estimates that overhauling those by contract is the most economical method considering the investment that would be needed in tools, testing equipment, etc., if done at The Company's shop.

In order to keep the salaries of aviation personnel competitive with those of other organizations, The Company conducts periodic surveys in industry to disclose current trends in salaries of such personnel.

A particularly pressing problem was in respect to junior flying personnel who are hired at the minimum range with necessary ratings but with little actual experience under their seat belts. The youngsters hired were put through a solid orientation course, serving in both the shop and in flight with older and experienced personnel.

Within two to three years, it was felt, this course of action moulded top quality men and, as important, produced a very uniform standard of performance both for flying and for maintenance.

To keep the salaries of such personnel in line with their constantly increasing skills, a progress pay increase program was adopted which recognized the skill increases of the new pilot personnel by salary adjustments at regular intervals—if fully warranted.

This program has reduced to a minimum the hiring away by competitors of The Company's younger flying personnel as skills were increasingly developed.

One remaining problem, however, concerns co-pilots in general—not only for The Company but for most business fleet operators. An official of The Company's flight section put it this way: "We realize that our younger co-pilots will in some measure continue to be lost because of the market demand for first pilot jobs which some of them are qualified to fill but which job we do not have available."

Because New York continues to be a center of many business activities, and because many business fleet activities are concentrated at an airport in an admittedly very high cost-of-living area, The Company found that actual living cost differentials have been necessary for pilot personnel in that area. Because of this, The Company has set its sights on keeping a few qualified young men already established in that area on the payroll. Shifting men to that area has proved costly.

One factor that The Company and any other must face was summed up by one of The Company's flight officials in this way: "There is a pronounced shortage of capable and skilled flying personnel due to the phenomenal growth of business flying which makes . . . younger efficient personnel a constant target for any company looking for such skills and willing to pay the price."

Back on the ground, The Company has kept a canny eye peeled for economies. Just as the planes themselves were bought from surplus, so have replacement parts so far come largely from surplus, whenever quality is equivalent to market standards. But soon, of course, those surplus supplies may vanish.

Close expense account scrutiny, and restriction of use of purchase orders by pilots and co-pilots to emergencies only have also been adapted as savings measures by The Company.

Procedures to insure recovery of State gasoline taxes is another key step in The

Company's economy ladder. Tire recapping where there are no structural defects is another economy measure.

Co-pilots are placed under contracts which insure fifty hours per week without overtime.

Shop emergency overtime is offset whenever possible by granting time off within the same payroll period.

The premium cost of The Company's aviation insurance has, of course, an appreciable effect on operating costs. During the survey period, premiums amounted to about $72,000 per year.

A study was made to explore economic justification for continuing coverage of "ground" and "crash" insurance. It was finally determined that, in view of the substantial reductions in premiums for such coverage over the past two years as a result of the extremely satisfactory operating record of The Company's fleet, the potential savings from eliminating this coverage was not sufficient to justify the gamble of self-insurance.

The Company's depreciation rate of twenty per cent is a high one and some operators do take longer times for amortization of their original investments.

Differences of accounting procedure, it is significant to note, are among the targets of the National Business Aircraft Association's continuing campaign for a standard accounting code among all business fleet operators.

It might be noted, as an example, that the flight crews' salaries in the case of The Company include a good deal of the "operating labor" expenses in keeping planes fit that might in other operations show up as bills from outside contractors.

As telling as The Company's experiences in the immediate past may be, it is in the speculation of its personnel as to what the future holds that some of the most revealing results of the survey are shown.

First of all, there is a strong tribute to the ruggedness of the equipment on hand. Each of the planes being flown by The Company was designed during the 30's. Yet, with sharp maintenance, the life of those planes seems almost limitless, although metal fatigue, longer maintenance time, and other "age" factors do jack up costs.

The big point about the planes is that, as good as they are, they do not reflect the full potential of the day insofar as design, power, ground maneuverability, safety, and comfort factors are concerned.

But, is there a full range of superior equipment waiting if The Company should decide to start replacing its planes?

Here is the revealing answer given by one of The Company's officials:

"Unfortunately, there are no truly modern airplanes on the market which may be used in business short of the Convair or Viscount class.

"Both of these airplanes are much larger than experience shows are needed in our type of operations and the original investment and operating costs make them undesirable.

"*We have to recommend that until there is on the market an airplane in the multi-engine category of appropriate size and weight with cabin pressurization, tricycle landing gear, modern design and up-to-date power plant at a reasonable price, we continue operating present equipment.*"

In one area, however, The Company does envisage a reason for some equipment replacement. Many of its personnel, it has found, prefer not to fly in single-engine aircraft despite the perfect safety record of the ships. (The high use figure for the Cessnas, it is appropriate to observe in this connection, is due in large part to the required constant use of those planes in The Company's operations.)

Possible replacements for single-engine craft, according to The Company's planners, would be the Twin *Bonanza*, Cessna 310, or Piper *Apache*, ranging in price from $103,000 all the way down to $49,000 fully equipped.

Despite the higher anticipated operating costs for these twin-fan ships, The Company's flight section has reported that "it seems certain that such light twin engine airplanes, because of their greater apparent safety—with the two engines—would have a much greater acceptance by our personnel and would result in a much greater utilization."

In that thinking, The Company sums up a major "X" factor in the use of business aircraft. It is the *utilization* of the planes by a concern's personnel that really makes the mark on the ledgers of the outfit more even than the marks of the operating costs.

The executive who gets to an important meeting on time, not harried by a long travel schedule, may recoup in a single good decision or wise counsel the entire cost of the fleet's operation.

Adds Flexibility

(*Continued from page* 13)

readiness. There was an instance in early 1954 which impressively brought home this point. One morning the Elmira plant manager discovered to his dismay that his supply of selenium was practically exhausted. Selenium, a decolorizer, is very necessary in the manufacture of clear (flint) glass. A hurry call was made to the nearest plant in Jeannette, Pa., and within 45 minutes the *Ventura* was on the way. In less than four hours from the initial discovery, the Elmira plant had enough selenium to keep operating until regular suppliers could replenish stocks.

In another instance, it became necessary for Board Chairman Pollock to be in three places practically all at once. Leaving the Thatcher office after perusing his morning mail, Pollock got aboard the company plane at 9:30 A.M. At 11:00 A.M. he was in conference at an office in downtown Manhattan. At 12:45 he was back aboard at Teterboro and enjoyed a leisurely lunch enroute to Washington. At 2:15 P.M. he was in a meeting with government officials. Returning to the airport at 4 P.M., he was flown to Elmira and at 5:45 P.M. he was back in the Elmira office heading up a meeting of the Sales Department. It ordinarily takes quite a vigorous individual to be this active in one day and it is only possible through the medium of a company plane. Regarding the value of a plane in company business, Pollock states:

"Naturally where time is of essence there is no substitute for a company plane. However, its basic value lies in the fact that it permits great flexibility of schedule by eliminating the timetable as a controlling factor in the planning of a more profitable business day."

Thatcher's executives appear to practice what they preach. In 1954, they flew 849 hours, or roughly about 175,000 miles. 1955 will approximate 1954 and 1956 will see the mileage increase slightly with perhaps fewer hours flown because of the faster cruising speed of the *Ventura.*

Lewis expects that the company will eventually add another smaller twin to supplement the hard working Lockheed *Ventura* as continued expansion creates demand for even more official travel. The lower operating cost of a smaller twin compares favorably with the cost of first class public transportation permitting staff company officials more convenience through better utilization of their time and thereby saving the company money.

The influence of Thatcher Glass operating a company owned airplane already has been felt by other business firms in Elmira. Ten years ago there was but one twin engine aircraft on the field, a B-23 owned by the Corning Glass Works. Today there are 2 DC-3's (Corning's), a Lockheed *Ventura*, a Twin Beech, an Aero *Commander*, a twin *Apache* plus several planes in the Bonanza-Navion class. It is forecast that by 1966 there will be double or triple this figure as business flying comes into its own as a necessary and vital adjunct to all business firms having extensive travel requirements. Probably the greatest contributory factor toward this end is the fact that the modern *thinking* business executive is airminded. And just as soon as he is pre-

sented with a practical business aircraft, either single or multi-engine, tailored to meet his needs and budget, he is not difficult to "sell."

Current business flying figures prove it. Unquestionably the best drum beaters for the use of business aircraft are the executives themselves whose companies already own one or more planes.

The history of the growth of Thatcher Glass Manufacturing Co. reads like an Horatio Alger novel. Back in 1884, the first milk bottle was patented and manufactured by Hervey D. Thatcher, a druggist in Potsdam, N.Y. The original bottles were sold to dairies by the H. D. Thatcher Company and as an inducement to buy the bottles only one dairy in town was offered the franchise.

When the manufacture and sale of Thatcher bottles was taken over from Dr. Thatcher, plants were established in Kane, Pa.; Dunkirk, N.Y.; and other cities.

Eventually a large and well equipped plant was needed so these locations were abandoned for a plant in Elmira, N.Y. Elmira had the advantage of being close to large supplies of raw materials.

To keep pace with the increasingly larger demand for milk bottles, fully automatic equipment was necessary. Therefore by 1912 the Thatcher Elmira plant was completely mechanized and an expansion program was begun. Still expanding, the Thatcher Glass Mfg. Co. now owns and operates glass container plants at Lawrenceburg, Indiana; Streator, Illinois; and Saugus, California. Milk bottle production alone amounts to 100 million bottles annually.

In addition to milk bottle production, Thatcher Glass manufactures many other types of glass containers—notably those for food, soft drinks, liquor, beer, wine, bleach, and other products requiring a glass container.

In 1952 the McKee Glass Company of Jeannette, Pa. was purchased by Thatcher and is now known as the McKee Division. This direct subsidiary manufactures glassware for industrial purposes such as automatic clothes washer windows, electric mixer and blender glass, large type lenses, stove knobs, and other items for industrial use as well as a complete line of heat resistant ovenware and kitchenware marketed under the name "Glasbake."

Lettering and designs also are moulded and printed upon Thatcher glass products, chiefly milk bottles. In 1933 the company developed a method of lettering called Pyroglaze. Ceramic paint is applied to a bottle by a silk screen stencil. The paint is then fused to the glass in a lehr, or oven.

It will be of interest for our fact-seeking readers to know that a milk bottle lives through an average of 41 round trips to the dairy; a soft drink bottle about the same. It is difficult to obtain accurate statistics on beer bottles because of the fact that many types of these bottles are interchangeable; however some beer bottles have been in service five or six years or more.

The Thatcher pilots, like thousands of other professional company pilots, are somewhat concerned regarding the aviation industry's long complacency about designing and building a plane tailored exclusively for business flying. "There are recent and pleasant noises being made in our direction," Lewis opines, "but it took a long time to get them going. Our company has a plane capable of a 260+ mph cruising speed right now, but to get a new pressurized version with this performance we would have to buy a Convair 440 which is both too large and expensive for our present requirements."

Lewis pointed out that we would like to see a pressurized business plane carrying from 10 to 12 passengers with a cruising speed of over 300 m.p.h. and a range of at least 2000 miles. "The *Super Ventura* or *Learstar*, if pressurized, would fill our needs for a long time to come," he concluded.

And it looks, after watching the annual net income of the Thatcher Glass Manufacturing Co. mount upward, as if this most progressive firm will have needs to be filled for a long time to come.

NBAA

(*Continued from page* 33)

off, the slight effect of the turn on the gyroscopic action of the prop may help it to go over or under the wing instead of through the cabin.

"While you're freezing the engine you should continue to feather the fan. This sets up a sort of mutual aid pact between the prop and the engine. As the oil pressure disappears and the engine starts its swan song, the reducing rpm should help the feathering system to do its part and the feathering fan will definitely help the engine to stop without throwing the prop.

"But, for the sake of discussion, let's assume that you have frozen the engine and still have the prop but it is still in low pitch. You may have gotten the shimmying and shaking stopped but those flat blades aren't doing you a bit of good. Be persistent —assert yourself—don't take no for an answer! Hit that feathering switch again!"

New Call-Up Procedures Recommended by NBAA

Expanded use of direct pilot/air route traffic control communications now seem to require procedures whereby the sector in the air traffic control center controlling a flight can identify its location by hearing the incoming call from the aircraft. At the present time, the pilot's call-up consists of the following: "Podunk center, this is NC 166, over." Since this call is received at several different sectors simultaneously, controllers must examine their postings to determine if the aircraft is in their sector. The controller concerned then replies to the pilot.

"To avoid this "seek and find" procedure by several controllers, the following typical call-up procedure is recommended by NBAA: "Podunk center, this is NC 166, Skytown, over." Only the sector controlling Skytown would be alerted by this call-up and the proper sector would answer immediately.

Midway Light Out Under Good Conditions

For several years, business pilots operating into Chicago Midway have grouched about the need for a distinctive light at the southeast end of runway 31L to assist in picking up the runway while making an approach.

Reports also have been received in regard to the relative usefulness of the stroboscopic guidance light. It has been said that during good visibility conditions it was dangerous to use. However, under very poor visibility conditions when back-course ILS approaches were being missed during snowfall, the light was turned on and from then on no more missed approaches were reported.

The Midway tower agrees that this light will not be turned on during good visibility conditions, but will be used with pilots' approval under poor visibility conditions. NBAA believes that business pilots will find this light helpful and requests that it be given a more thorough and exhaustive trial under adverse conditions.

Now Hear This

(*Continued from page* 5)

pointed manager of RCA's new Flight Laboratory.

Sidney C. Howell has been appointed eastern sales manager for the Weatherhead Company's aviation division.

Norman Kidd, formerly head of Braniff Airways' Los Angeles sales office, has been appointed New York City sales manager.

James H. Brewster III has been appointed director of customer relations of the electronic systems division of Sylvania Electric Products Inc.

Jack Morris recently was named superintendent, maintenance, Riddle Airlines.

C. A. Thomas has been promoted to the position of general manager of sales for Stratoflex, Inc. He formerly was sales engineer.

E. Van Vechten has been named manager of airline sales of Air Logistics Corporation.

F. Charles Burton recently was appointed buyer for General Aircraft Supply Corporation.

Thomas R. Foster has been named to head Southern Airways Company's new aircraft brokerage department.

Richard S. Finke was named supervisor of executive aviation sales and **Charles O. McAtee** was named executive aviation sales engineer for Bendix Radio Division.

Jack Wright, former sales manager of the Garrett Corporation's aero engineering division, has been promoted to the position of assistant manager.

John A. Doremus has been appointed vice president in charge of engineering of Aircraft Radio Corporation.

S. J. Pipitone recently was appointed manager of the design analysis department at Goodyear Aircraft Corporation.

Ross I. Newmann was appointed chief of Civil Aeronautics Board's international and rules division, office of general counsel.

Rudolph Deetjen, senior partner of Emanuel, Deetjen and Co., recently was elected a director of Piasecki Aircraft Corporation.

A. J. Rome has been elected president of Aircoach Transport Association.

Joseph E. McDonald, Jr., has been appointed to the military sales staff of Beech Aircraft Corporation.

Arthur H. Jones has been appointed director of engineering of Motorola's national defense department.

George M. McSherry, manager of New York International Airport for the past eight years, has been appointed assistant general manager of the four metropolitan airports operated by The Port of New York Authority.

COMPANIES

Bendix Aviation Corporation has acquired a substantial interest in Aviation Electric Limited which will now operate in Canada as a Canadian affiliate of Bendix.

Airwork Corporation has been appointed East Coast distributor for Wakmann Watch Co., a manufacturer of aviation clocks and precision instruments.

Captain Eddie Rickenbacker, board chairman of Eastern Airlines, received the "Distinguished Salesman of the Year" award from the Sales Executive Club of New York.

AERO CALENDAR

May 19—Armed Forces Day. Throughout the world, "Open House" will be held by all the military services. The theme will again be POWER FOR PEACE.

June 18-21—Annual national summer meeting of the Institute of Aeronautical Sciences, Los Angeles, California.

June 21-22—Twenty-seventh meeting, Aviation Distributors and Manufacturers Assn., Grove Park Inn, Asheville, N. C.

HONORS

Aeronautics Committee of the American Legion recently was presented Certificate Number One of the Aviation Incentive Movement.

Dr. George P. Cressman of USAF Air Weather Service received the highest Air Force civilian honor, the Decoration for Exceptional Civilian Service.

Wendell E. Reed, Solar Aircraft Company project engineer, was awarded the Wright Brothers Medal by the Society of Automotive Engineers.

General Nathan F. Twining, Chief of Staff of the U. S. Air Force, was the 1956 recipient of the General William Mitchell Award of the Aviator's Post No. 743 of the American Legion.

Pilot's Report

(*Continued from page 15*)

outside temperature was 50 degrees.

When you shovel the coal on the furnace there's a momentary pause. The plane rolls a few feet as though hunching itself for the effort of takeoff. Then that 230 hp Continental takes hold. It feels as though the 182 just got stung on the tail by a horde of hornets. You're glued to the back of the seat by the rapid acceleration. It's an exhilarating experience that you'll want to re-experience at every opportunity.

On a turf field with an uphill grade, we broke ground in 12 seconds. This was first takeoff in a strange airplane. A later takeoff on a concrete runway was made in 7 seconds—an indication of fast acceleration and short takeoff distance.

First thing on the flight agenda was a four direction cruising speed run. As we bounced across the tree tops pulling 23 inches of manifold pressure and using 2300 rpm, the air speed indicator jumped back and forth between 150 and 155 mph. Actual times were 26, 24, 23 and 22 seconds each for one mile. This was not intended to be an accurate test. It only indicates what might be expected from a pilot flying a strange airplane. As has always been the case, the factory seems to have been conservative in publishing performance figures.

Later on in the flight we leveled off at 6400 feet where the air was silky smooth. The air speed stabilized at 155 mph indicated. Corrected for the 25 degree temperature and altitude it figured a true air speed of 168 mph. This was attained with full throttle and 2400 rpm, which Ward told me was 70 per cent of power.

In checking climb, we selected an indicated airspeed of 110 mph. Ward told me this was not the best rate of climb but was a good normal climb out for a cross country trip. In just 5 minutes and 13 seconds we were 5000 feet above the ground. This kind of performance will certainly get you to cruising altitudes in a hurry and still give you a reasonable ground speed while attaining it. My guess is that most pilots will settle on 120 mph indicated for normal climb. This may give you a little less than 1000 fpm climb. But at least the nose will be low enough that you can comfortably watch for other traffic.

While we were climbing, Ward said that he and several others from the sales department had climbed to 19,000 feet a few days before. At that altitude the airplane was still indicating 350 fpm climb. In level flight the indicated air speed had been 105 mph which figured out to 146 mph true.

While at altitude we tried a few stalls. Cessna airplanes have always had a good reputation for fine stall characteristics. But this was uncanny. With flaps up, the airplane was slowed down, keeping the nose in as near level position as possible. The stall warning born sounded at 60 mph indicated. At 50 mph the wheel was all the way back and absolutely nothing happened. There was no shudder or shake, no dropping of the nose or falling off on a wing. We just hung there as though suspended on some friendly sky hook.

After several minutes of waiting for something to happen, I finally rolled the ailerons to the left. The left wing went down and almost immediately we felt the shuddering and shaking that you associate with a normal stall. The nose pitched down slightly, but a mere relaxation on the elevator pressure and everything was solid and under full control.

With flaps down, the warning horn came on at 50 mph indicated and we began to shake and shudder at 40 mph indicated. Here again the stall was exaggerated by holding the wheel all the way back. The slight pitch or roll was easily controlled by merely relaxing back pressure on the wheel.

While it would take several hours of playing around with stalls in different conditions to really learn all the characteristics and their implications, the indications are that the 182 is a very gentle airplane and would forgive many mistakes.

No matter how much you may love the airplane at this point, you won't know what true love really is until you start shooting landings. The 182 is about as docile as any airplane I've ever flown. Flaps up, flaps down, flaps partially down—in any condition it's easy to make the landing.

Ward suggested 80 mph as a normal approach speed. This is 20 mph above the horn warning with flaps up and 30 mph above with flaps down which seems an adequate margin of safety. And this speed gives adequate flare-out control.

At 70 mph there isn't much elevator control left. You've got just enough to pull the tail down and then the airplane is all through flying. One other approach was made at 100 mph. At this speed there is usually a pronounced roller-coastering while trying to float off excess speed. Although this is pilot-induced, there aren't many who can keep from over controlling a bit. For some reason this didn't seem to be so much of a problem with the 182. While there was plenty of control, there was a *softness* that reduced the tendency to over control.

Several days after this flight I had the opportunity of discussing the airplane with a personal friend of mine who is an employee of Cessna. He is not a test pilot—not even a professional pilot. His total time on the airplane had been less than three hours. But he had been making 90 degree cross-wind landings in winds of 30 mph with gusts. At times he would contact the ground crabbing with a wing down to offset drift. In every case as soon as the one main gear contacted the ground, it seemed to automatically pull the plane into line with the direction of landing without swerving or *cutting up* in any manner. This is built-in safety, the kind that brings peace of mind and protection of a $13,750 investment. It also brings fuller utilization of the airplane, for it can be used under wind conditions that would ground many part-time, businessmen pilots.

No matter how safe an airplane seems to be, when it gets into the hands of the public some *dope* is going to find a way to wreck it. But to my mind, here, for the first time, is a high performance airplane that almost any pilot can handle safely and easily. For personal pleasure, business flying or charter work, the 182 is a rugged, smartly handsome airplane that can fill the bill.

After flying the 172, I said in the November 1955 issue, " . . . within a year the

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Automation

(*Continued from page* 17)

effects. This is of particular importance to propeller driven transport aircraft where changes in propeller slipstream over the wing makes for significant changes in wing lift.

When installing the *Speed Control* unit, all the computer calibration and adjustments are made in one flight and the unit is locked up. While Safe Flight recommends certain margins of operation, the operator can name his own requirements.

With speed control indicators mounted on the panel or glare shield, the pilot and co-pilot are presented with lag-free lift-ratio data. Swinging through a 75° arc on the face of the indicator, the needle reads from *slow* on the left to *fast* on the right. The indications are in terms of percentages above stall speeds.

These four components, then, make up Safe Flight's speed control system. Using the null-type reading presentation of the indicator, the pilot can fly by a single pointer that takes into account any and all factors that affect wing lift. It permits greater pilot accuracy in controlling minimum speeds, particularly important during landing approaches, take-offs and holding procedures.

Using the basic speed control system, Safe Flight has added three more components to provide *Autopower,* a lift-coupler-amplifier, a controller switch, and a throttle servo. Linked to the throttles, the automatic control system locks the airplane to a calibrated or adjustable lift ratio. By automatically adjusting the throttles, the system will maintain this lift ratio during ILS and GCA holding procedures and approaches.

The basic speed control system signal is used by the *Autopower* system to drive the throttle servo unit and, in doing this, the coupler-amplifier converts the d.c. speed control output signal to 400 cycle a.c. and amplifies this signal. The a.c. signal is modified by a rate-feedback signal from the throttle servo motor, producing a tight servo coupling.

The controller unit, which is mounted on the right side of the Safe Flight DC-3's pedestal, has "ready" and "engage" switches. Its control knob, marked in the same fashion as the speed control indicator on the panel, permits the pilot to select the lift ratio to be flown. As an example, Safe Flight's DC-3 system has been set to operate in a range from fifteen to sixty-five per cent above the varying stall speeds.

The throttle servo incorporates a multiple drum mechanism to drive the throttles. The pilot can over-ride the servo by manual operation of the throttle or he can instantly disconnect the system by means of an electrical release button mounted on the control column.

And that's *Autopower.*

Explaining the system, Leonard M. Greene, president of the company, has said that the function "is to automatically control the power to its optimum value. The advantage of the system is both its precision speed and power control, while greatly reducing the human factor during the difficult landing maneuver through automation."

Changes in aircraft attitude, he said, "flaps, landing gear, weight, and all the other variables which affect lift, are sensed before the changes in speed take effect and are compensated for by the application or reduction of engine power through automatic throttle adjustment.

"Once *Autopower* has been installed and calibrated in the airplane, the system can be used throughout the entire approach, or at any time auto-control of the throttles is desired in the low-speed range, with no pilot adjustment necessary."

Safe Flight has been developing and testing *Autopower* over the past three years in two of its own planes, a Cessna 170 and the DC-3. When offered the opportunity recently to test-flight *Autopower* in the -3, I eagerly accepted the chance to see this robot throttle system first hand.

Bob Jones, Safe Flight's chief pilot, and George Thom, pilot and member of the sales department, met me on a clear, cold morning at Teterboro. After a briefing by Bob on the system we taxied to Runway One, received tower clearance and took off. And right here Bob made real character with me, he utilized the aircraft's check list throughout the entire flight.

Dual speed control indicators are mounted on the -3's panel. The needle, Jones explained, when on the center mark indicated an airspeed 40 per cent above stalling speed. When it sank to a position over the "W" in *slow,* it indicated an airspeed 20 per cent above stalling. This just happens to be the speed ratios selected by Safe Flight for its -3. It could well be different, but once calibrated for a particular aircraft, the indicator will always take the same position for the same ratio of airspeed to stall speed no matter the weight of the plane.

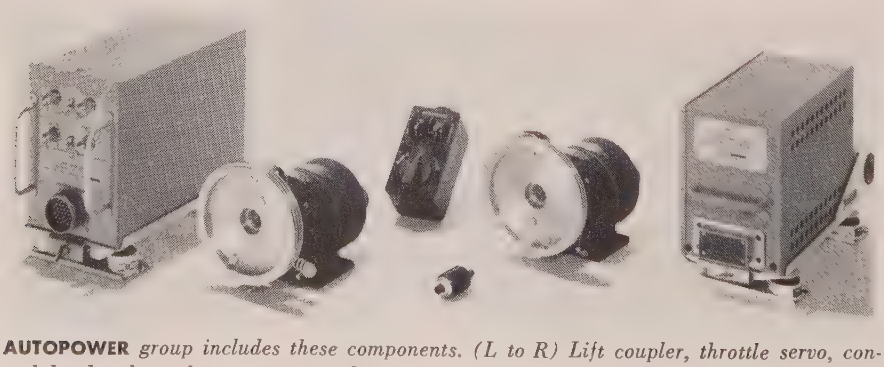
We climbed above scattered clouds at 5,000. Over Westchester at 6,000, Jones flipped up the ready switch on the *Autopower* controller and set the knob selector at the center point. A few minutes later, the engage switch on the controller was flipped up and the plane pushed over into a glide. Almost instantly the throttles started back. Our airspeed indicator read approximately 85 knots. When Jones lifted the nose, the throttles responded instantly, supplying power to maintain our 40 per cent speed cushion.

With *Autopower* the pilot is not called upon to divide his attention between navigation, following the ILS needles or responding to the tower controller's instructions, plus control of his airspeed when making an ILS or GCA approach. His chances are greatly increased of not only arriving at the right spot over the end of the runway at the right speed.

Pilot landing technique, is not always a precision maneuver. He is constantly actuating his elevator, trim tabs, radios and throttle controls. This fact, plus the increasing speeds of aircraft, has forced the runway construction problem to almost unacceptable limits. Runway lengths have had to be increased as much to accommodate all classes of pilots as to accommodate our increasingly high-performance aircraft. With jet transport and even jet business craft operation impending, the problem is fast reaching economic limits. *Autopower* and other automatic landing controls certainly seem to be marking out the only path we can follow in our attempt to balance out the factors of increasing aircraft speeds, lower weather minimums, pilot technique and runway length.

A report from a recent special IATA meeting on final stages of instrument approach and landing sums up the pilot's position on such automatic controls. It preambled that "Pilots in general tend to carry excess pads of speed in the interests of aircraft stability in the approach. With increasing speeds of landing aircraft and other factors, pilots will not be able to carry extra speed usually carried by many pilots on final approach today."

COMPONENTS *of the Safe Flight Instrument Co.'s "Speed Control" system are (L to R) lift computer, wing lift transducer, flap potentiometer, and cockpit speed control indicator.*



AUTOPOWER *group includes these components. (L to R) Lift coupler, throttle servo, control head, release button, servo and servo amplifier. Stall warner preceded both systems.*

The report then went on to say that "The question was asked, whether, given an automatic throttle control, this tendency would be eradicated. It was the consensus that, provided pilots had confidence in the particular 'Black Box,' and could over-ride its signals, if necessary, they would be willing to use the optimum approach speed on all occasions, and therefore derive considerable help from its use."

Experience and evaluation would indicate that's a fair statement of the situation today. *Autopower*, in time, certainly should gain pilot confidence.

I flew the airplane in various attitudes, *Autopower* on. The throttles responded to changes in wing lift more quickly than I would have responded manually. Though I'm not sure, because of my strangeness of not handling the throttle controls myself, I almost felt as though they responded too rapidly, making for uneven flight.

When I questioned Jones, he told me that the particular *Autopower* installation we were flying had been given extreme sensitivity. I assume this had been done for demonstration purposes. Undoubtedly, were I to fly this system regularly, I would soon accommodate my own control of the plane to *Autopower's* rapid response. The sensitivity of an *Autopower* installation is established through adjustments to the throttle servo.

Fail-safe for *Autopower* goes through three steps, assuming a stall warning device is part of the equipment. Excluding the pilot's realization that engine power is not responding to changes in the aircraft's attitude, a flag appears in the speed control indicator, the servo fixes the throttles and, if speed should drop toward the stall point, the stall warning device shakes the control column.

Swinging back to Teterboro, we tied the approach coupler in on the ILS and flipped on *Autopower*. *Autopower*, incidentally, can be used on aircraft not equipped with auto-pilot or approach coupler. With a 90° crosswind, the -3 ran through the dipsie-doodles in the beam itself, throttles adjusting automatically as power was required to maintain over 40 per cent above stall speed.

When we reached the flare-out point, we pressed the quick disconnect button and brought her on in. *Autopower* definitely can increase your percentage of completed precision approaches.

A prominent transport manufacturer has given *Autopower* a thorough evaluation. Installed in one of their multi-engine aircraft, they ran it through a scientifically recorded flight test program. Their report to Safe Flight indicated a 400 per cent greater stability during approach.

Is there anything wrong with *Autopower?* Basically no. But as with all other new devices designed to take over a portion of pilot responsibility, I think it will have to go through a period of indoctrination before we pilots are completely willing to delegate to *Autopower* this vital responsibility which has tagged us "throttle jockeys." This is no reflection on *Autopower*, it's just a reflection of a pilot's normal conservatism.

NAVICOM

(*Continued from page* 31)

pilot) ending about 30 minutes prior. This training flight utilized a pre-flight check which included the functional testing of the feathering of both propellers. (This check is required by the carrier prior to every flight.) No malfunction was noted in engine or propeller performance.

All airborne radio, navigation, and communications equipment was used without malfunction during this prior flight which included a single-engine instrument approach. During the investigation all airborne radio units were examined and no evidence was found to indicate that they had not been in operating condition prior to impact. Immediately after the accident all ground radio facilities including the ILS for Runway 7 were tested; all functioned normally.

Since the crew neither survived nor described the emergency by radio it is only possible to reconstruct what transpired on the flight deck by consideration of the factual material already presented. This material includes the following items considered pertinent.

Takeoff was under visual flight rules and was made toward the south-southeast into haze which restricted horizontal visibility and bordered on conditions requiring instrument flight. There is nothing to indicate that flight by visual references had been discontinued when the emergency was caused by the difficulty with the right engine one to two minutes later.

The aircraft was loaded close to but within legal limits and the performance of this model so loaded is known to be such that a safe margin exists which would have permitted it to climb on one engine at takeoff power. Climb would have been possible if the gear had been retracted, the propeller had been feathered, or any thrust at all had been developed by the malfunctioning engine. These known performance data indicate that N 74663 was not incapable of making a safe return after use of its right engine had been discontinued.

When the malfunction occurred the captain may have considered his altitude insufficient for safe transition from visual to instrument flight. He may have tried to continue flight by visual references only, or he may have been guided by the ILS Inner Marker at the approach end of Runway 7. The flight path after the emergency was announced indicated single engine operation, and since the malfunction did not cut-out the engine the captain may have reduced power on that engine as done in Currey's practice of single-engine flight; or he may have tried unsuccessfully to feather the right propeller. The fully closed position of the right engine shut-off valves indicates that feathering was attempted.

The captain did not, and possibly could not, climb to 2,000 feet and follow that portion of the single engine procedure. He did circle to the right for an approach to Runway 7. If he used his radio and the localizer he needed a base leg some distance out to enable him to align the runway by that means. If he depended on visible landmarks he needed a base leg close in to identify known landmarks as aids in accomplishing alignment. It is possible that the base leg he selected was too close in for the one technique and too far out for the other. In any event, alignment was not accomplished. Because of the extended gear, the unfeathered right propeller, and the low airspeed then remaining, he was unable to maintain level flight but continued to the airport area, losing altitude all the way, and failed to clear the last power line in his path.

On the basis of all available evidence, the Board determined that the probable cause of this accident was the captain's irrevocable commitment to a landing without radio or visual confirmation of his runway alignment following engine failure immediately after take-off in near minimum visibility.

[Ed. Note: This condensed version of the CAB report is offered solely as a reminder that the temptation is strong in an unexpected emergency to discard carefully built-up practices of safe emergency procedures and hang on to straws, such as trying to retain ground contact or get back on the ground unduly soon. The only moral to be drawn, if any, is:—if the situation fits a procedure which training and practice has shown you is practical, use it and stay with it!]

NBAA Warns Pilots On Descent-Climb After IFR

ZOOOM! Where did that plane come from? Have you heard words like these before? "Cleared IFR, cancelled clearance and started my VFR descent. At that moment another plane came from directly underneath me. Checked with approach control and it was a DC-7 on an IFR clearance 2000 ft. below our plane." For safety's sake, a positive turn in each direction before any descent or climb under such circumstances, particularly, after actual IFR conditions, would be a good plan to follow. Also a check with ATC for other traffic, if time permits, would be a good idea.

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PLANES FOR SALE

STINSON: 1947 Small tailed 165. Custom metal. G. L. Holman, 2811 Central Ave., Cheyenne, Wyo.

POSITION WANTED

COMPANY PILOT: instrument rated with extensive airways experience. Commercial license, all ratings, 3000 hours, 10 years flying, ex-Air Force. College graduate, age 30. Presently employed flying single and multi-engine, desires change to corporation flying position. Call Market 1-8900, San Francisco. Write Skyways, Box No. 707.

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Fuels—Oils

(Continued from page 35)

cified for use in a particular engine will cause *no* trouble that is attributable to its higher knock value, thus disposing of the fear of using "too powerful" fuel, in the engines of lighter business aircraft.

Using such fuel, which may contain more TEL than the lower grade fuels, *may* bring on problems associated with "leading," such as valve burning, increased deposits, and corrosion of some parts after prolonged usage.

(Regarding TEL content, it would be appropriate here to point out an inadvertently misleading statement in the March Fuels-Oils section. In that issue, a story referred to the "usual" content of 3 c.c.'s of TEL for 91 octane avgas and 3 and 4 c.c.'s for 100. Esso Standard points out that, domestically, it "is the only petroleum supplier distributing through normal channels avgas" in which both grades 91 and 100 contain a *maximum* of 3 c.c.'s lead. Esso points out that the "usual" content of *other* suppliers is approximately 4 c.c.'s.)

As an example, of permissible fuel-use latitude, using Grade 80 fuel in an engine for which 73 has been specified will result in *as good* and probably *better* performance, from a knock point of view alone. The higher anti-knock value means that detonation is resisted under severe operating conditions such as full throttle climbs and low air speed where engine overheating is a problem.

Often a higher octane value is required after engines have been run long enough to build up appreciable deposits in the combustion chambers.

The pilot fear about heating his engine with "high power" fuel actually *might* be realized by using too low a fuel in terms of anti-knock value.

The general rule: *when it is impossible to obtain proper fuel, use the next higher grade.*

(If the next lower grade *must* be used due to an emergency condition, the carburetor should be left in full rich adjustment and high throttle settings should be avoided. Rate of climb must be kept moderate. UNDER NO CIRCUMSTANCE SHOULD AN ENGINE BE FLOWN ON FUEL AS MUCH AS TWO GRADES LOWER THAN THAT SPECIFIED.

PERFORMANCE NUMBERS ABOVE 100

Performance Number	*Knock Value	Performance Number	*Knock Value	*Knock Value	Performance Number	*Knock Value	Performance Number
100	0.00	131	1.36	0.0	100.00		
101	0.02	132	1.43	0.1	103.96	3.1	147.24
102	0.05	133	1.51	0.2	107.43	3.2	147.90
103	0.07	134	1.59	0.3	110.52	3.3	148.53
104	0.10	135	1.68	0.4	113.30	3.4	149.15
105	0.13	136	1.77	0.5	115.81	3.5	149.76
106	0.16	137	1.86	0.6	118.12	3.6	150.34
107	0.19	138	1.96	0.7	120.24	3.7	150.91
108	0.22	139	2.06	0.8	122.20	3.8	151.47
109	0.25	140	2.17	0.9	124.03	3.9	152.01
110	0.28	141	2.28	1.0	125.73	4.0	152.54
111	0.32	142	2.40	1.1	127.33	4.1	153.06
112	0.35	143	2.52	1.2	128.83	4.2	153.56
113	0.39	144	2.65	1.3	130.25	4.3	154.05
114	0.43	145	2.78	1.4	131.59	4.4	154.53
115	0.47	146	2.92	1.5	132.86	4.5	155.00
116	0.51	147	3.06	1.6	134.07	4.6	155.46
117	0.55	148	3.22	1.7	135.22	4.7	155.91
118	0.59	149	3.37	1.8	136.32	4.8	156.35
119	0.64	150	3.54	1.9	137.37	4.9	156.78
120	0.69	151	3.72	2.0	138.37	5.0	157.21
121	0.74	152	3.90	2.1	139.33	5.1	157.62
122	0.79	153	4.09	2.2	140.26	5.2	158.03
123	0.84	154	4.29	2.3	141.15	5.3	158.42
124	0.90	155	4.50	2.4	142.01	5.4	158.81
125	0.96	156	4.72	2.5	142.83	5.5	159.20
126	1.02	157	4.95	2.6	143.63	5.6	159.58
127	1.08	158	5.19	2.7	144.40	5.7	159.95
128	1.14	159	5.45	2.8	145.14	5.8	160.31
129	1.21	160	5.71	2.9	145.87	5.9	160.66
130	1.28	161	5.99	3.0	146.56	6.0	161.01

PERFORMANCE NUMBERS BELOW 100

ON[1]	PN[2]	ON	PN
100	100.00	79	57.14
99	96.55	78	56.00
98	93.33	77	54.90
97	90.32	76	53.85
96	87.50	75	52.83
95	84.85	74	51.85
94	82.35	73	50.91
93	80.00	72	50.00
92	77.78	71	49.12
91	75.68	70	48.28
90	73.68	**PN**	**ON**
89	71.80	99	99.72
88	70.00	98	99.43
87	68.29	97	99.13
86	66.67	96	98.83
85	65.12	95	98.53
84	63.64	94	98.21
83	62.22	93	97.89
82	60.87	92	97.57
81	59.57	91	97.23
80	58.33	90	96.89

PN	ON	PN	ON
89	96.54	68	86.82
88	96.18	67	86.21
87	95.82	66	85.58
86	95.44	65	84.92
85	95.06	64	84.25
84	94.67	63	83.56
83	94.27	62	82.84
82	93.85	61	82.10
81	93.43	60	81.33
80	93.00	59	80.54
79	92.56	58	79.72
78	92.10	57	78.88
77	91.64	56	78.00
76	91.16	55	77.09
75	90.67	54	76.15
74	90.16	53	75.17
73	89.64	52	74.15
72	89.11	51	73.10
71	88.56	50	72.00
70	88.00	49	70.86
69	87.42	48	69.67

[1]ON = Octane Number [2]PN = Performance Number
*Knock Value = ml. TEL/US Gal. in Iso-octane.

$$PN = \frac{2800}{128 - ON} \qquad ON = 128 - \frac{2800}{PN}$$

Pilot's Report

(Continued from page 47)

172 would make up the great majority of their small plane production." I understand that today only three 170's are coming off the line each week while seven 172's are being produced *each day*. I should probably quit while ahead, but I'll bet my grandfather's corn cob pipe against your grandmother's crocheted anti macassars that the same pattern will hold true for this fine new airplane.

PRICE $13,750
SPECIFICATIONS
Engine: Continental O-470-L 230 hp @ 2600 rpm
Top Speed: Over 160 mph
Cruising Speed: Over 150 mph
Cruising Range: Over 4½ hours
Rate of Climb (sea level): 1100 ft per min
Service Ceiling: 19,000 ft
Gross Weight: 2550 lbs
Empty Weight: 1510 lbs
Luggage Compartment Allowable Load: 120 lbs
Fuel Capacity: 60 U.S. gals max
Span: 36 ft, Length: 26 ft
Height: 9 ft 4 in, Wing Area: 175 sq ft
Wing Loading (per sq ft): 14.6 lbs
Power Loading (per hp): 11.1 lbs
STANDARD EQUIPMENT
Adjustable front and rear seats
Airspeed Indicator
All-metal constant speed propeller
Altimeter, Ammeter
Ash trays, three individual
Attachment for cargo rings and harness
Attachments for sun visor
Battery, 12-volt
Cabin air vents (six); Cabin heater
Carburetor air filter
Carburetor heater
Cigarette lighter
Circuit breakers
Compass
Direct reading fuel gauges inside cabin
Dome light
Hydraulic, toe-operated brakes
Dual magnetos and ignition systems
Muffler (stainless steel)
Engine ignition shielding
Foam rubber seat cushions
Fuel selector valve—four positions
Generator
Gravity fuel system
Instrument panel lights (adjustable)
Key-operated door lock
Key-operated ignition
Landing lights, two
Manifold pressure gauge
Map compartment, Map light
Mixture control with safety lock
Navigation lights
Oil pressure gauge
Oil temperature gauge
Outside baggage compartment door
"Para-lift" flaps
Parking brake
Propeller spinner
Recording tachometer
Shock-mounted instrument panel
Shoulder harness fittings
Space for optional instruments
Stall warning indicator
Starter
Suit hanger in cabin
Retractable tie-down rings
Windshield defroster